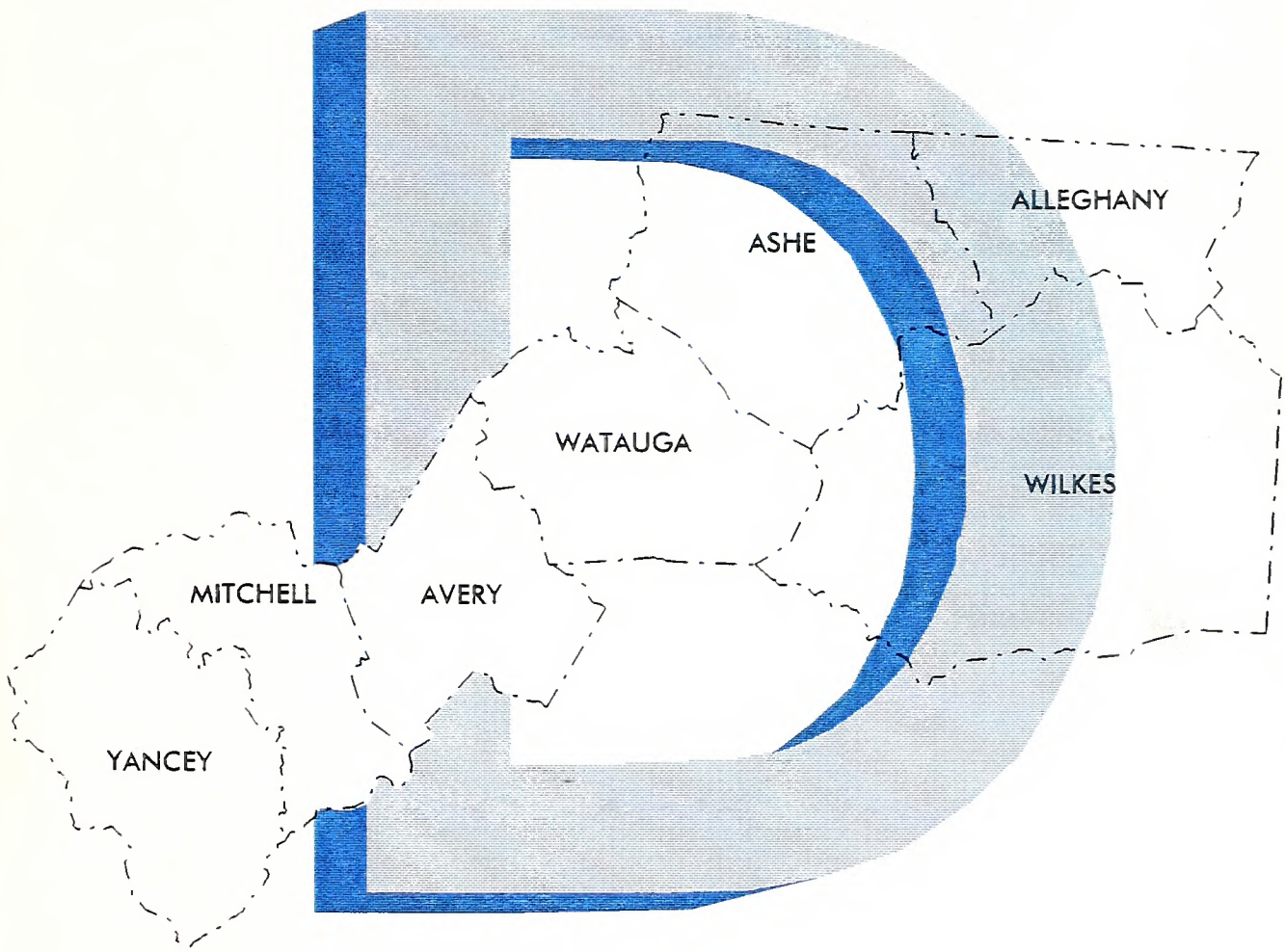
North Carolina Department of Transportation
Statewide Planning Branch
Small Urban Planning Unit

Thoroughfare Plan

for

REGION D

ALLEGHANY COUNTY ASHE COUNTY AVERY COUNTY
MITCHELL COUNTY WATAUGA COUNTY WILKES COUNTY
YANCEY COUNTY



September, 1993

THOROUGHFARE PLAN

FOR

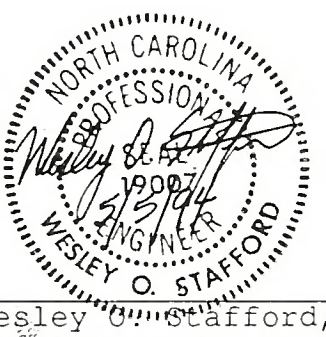
REGION D

Prepared by the:

Statewide Planning Branch
Division of Highways
N. C. Department of Transportation

In Cooperation with:

The Region D TTC
The Region D RTC
The Federal Highway Administration
U. S. Department of Transportation



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ACKNOWLEDGMENTS

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I. INTRODUCTION

The economic development of a region can be greatly influenced by how efficiently the transportation system handles travel demands. If the system fails to provide the means for the quick and convenient transportation of people and goods, the region's economic growth will stagnate and fail to reach its potential. It is necessary that the transportation system not only meet existing travel demands, but also keep pace with the development of the region. This report will set a system of major roads and highways required to satisfy the anticipated needs of Region D for the next thirty years. Certain priorities shall be established in the development of the thoroughfare system. These priorities will be based on maintenance needs, bridge inadequacies, poor alignments, and insufficient present and future roadway capacities.

The system of major roads and highways proposed was developed following the basic principles of thoroughfare planning as described in Chapter II of this report. The plan recommends those improvements that are felt to be essential for proper traffic circulation within the current planning period (1992 - 2020).

Most of the proposed improvements will be the responsibility of the North Carolina Department of Transportation. However, the Counties of Region D can provide assistance in the implementation of the plan through subdivision regulations and zoning ordinances. This plan has been formally adopted by both the County Commissioners and the North Carolina Board of Transportation to serve as a mutual official guide in providing a well coordinated, adequate, and economical major thoroughfare system.

The Planning Area - Historic Background

Region D consist of Alleghany, Ashe, Wilkes, Watauga, Avery, Mitchell and Yancy counties. These counties are located in the Blue Ridge Region of the Land Resource Regions of North Carolina. This major land resource area has elevations ranging from 984 feet in the lower valleys and foot slopes to over 6,600 feet in the mountains along the North Carolina - Tennessee boundary. More than two - thirds of the land area is forested, and about twenty percent is made up of national parks and forests, with many parts being popular recreation and resort locations. Small farms (mostly part-time enterprises) in coves and valleys compose the croplands, which make up one-tenth of the region's land area. Few natural lakes exist in the region, but many of the area's rivers feature dams used for flood control, recreation and the production of hydroelectric power. The lower mountain slopes and valleys support Appalachian Oak Forest vegetation such as white pine, hemlock, with oak-red oak-hickory, chestnut oak, northern red oak-basswood-white ash, loblolly pine-shortleaf pine and yellow poplar-white oak-northern red oak, while balsam fir and red spruce grow in the higher elevations. Understory vegetation consists of hornbeam, dogwood, sassafras, pawpaw, persimmon, greenbrier, leatherwood, mountain-laurel, rhododendron and witchhazel.

Alleghany County

Alleghany was formed in 1859 from Ashe. It was named for an Indian tribe, and the name is derived from "a corruption of the Delaware Indian name for the Alleghany and Ohio Rivers" and is said to have meant "a fine stream." It is in the northwestern section of North Carolina and is bounded by the state of Virginia and Surry, Wilkes and Ashe counties. The present area is 225 square miles and the 1990 population was 9590.

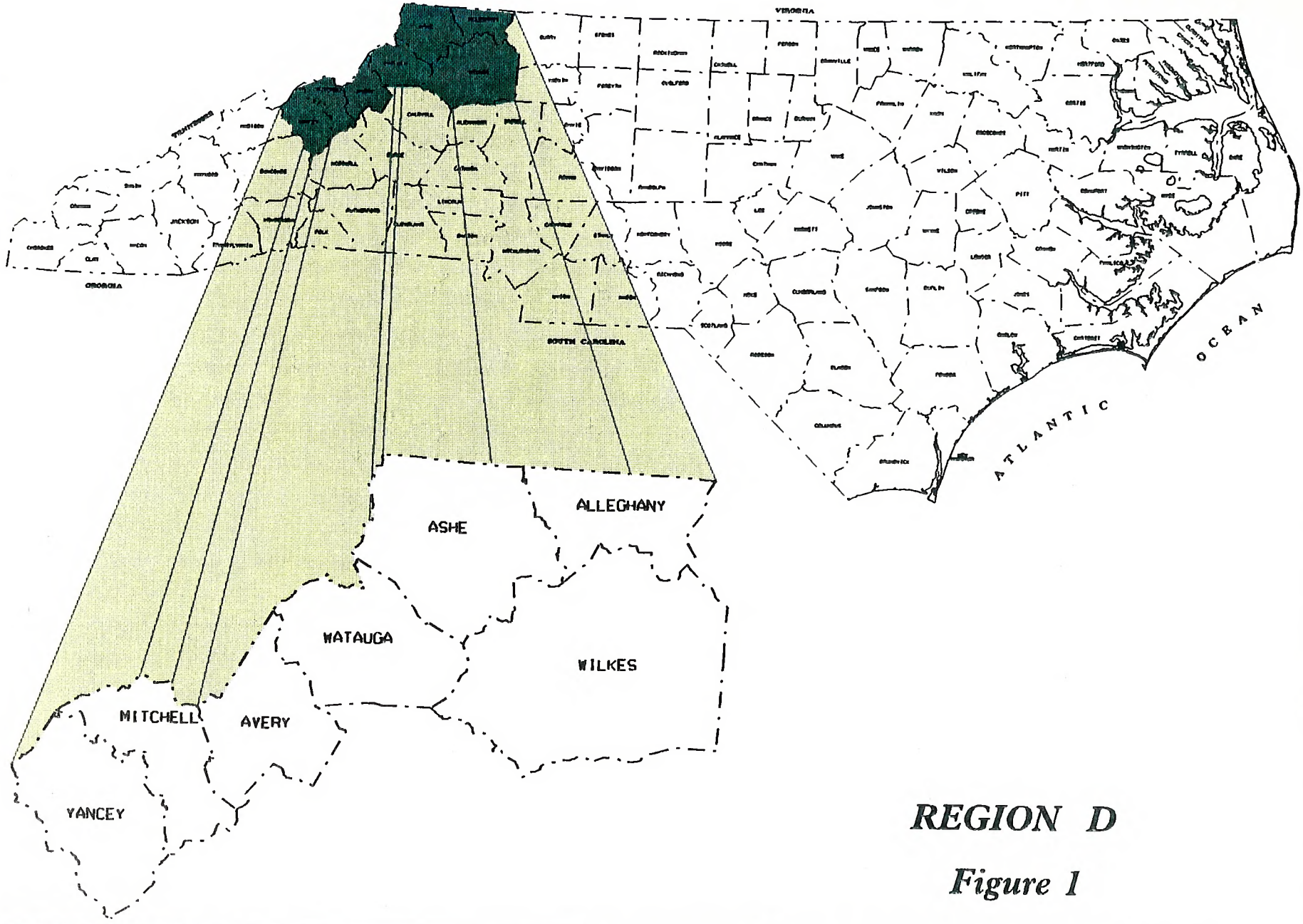
Ashe County

Ashe was formed in 1799 from Wilkes. It was named in honor of Samual Ashe, a Revolutionary patriot, a superior court judge, and Governor of the State. It is in the northwestern section of the State and is bounded by the states of Tennessee and Virginia and the counties of Alleghany, Wilkes and Watauga. The present area is 426 square miles and the 1990 population was 22,209.

Wilkes County

Wilkes was formed in 1777 from Surry and the District of Washington. The act was to become effective February 15, 1788. It was named in honor of John Wilkes who was a violent opponent of the Tory party in England. He was not allowed to take his seat in Parliament to which he had been elected.

Geographic Location



REGION D

Figure 1

The Americans imagined that he was suffering in the cause of liberty and named this county in his honor. It is in the northwestern section of the State and is bounded by Yadkin, Iredell, Alexander, Caldwell, Watauga, Ashe, Alleghany and Surry counties. Its area is 757 square miles and the 1990 population was 59,393.

Watauga County

Watauga was formed in 1849 from Ashe, Wilkes, Caldwell and Yancey. It was named for the Watauga River, which name came from an Indian word meaning "beautiful water." It is in the northwestern section of the State and is bounded by the State of Tennessee and Ashe, Wilkes, Caldwell and Avery Counties. The area is 217 square miles and the 1990 population is 36,952.

Avery County

Avery county was formed in 1911 from Mitchell, Watauga, and Caldwell. It was named in honor of Colonel Waightstill Avery, a soldier of the Revolution and Attorney General of North Carolina. It is in the northwestern section of the State and is bounded by the State of Tennessee and the Counties of Watauga, Caldwell, Burke, McDowell and Mitchell. The present area is 245 square miles and the 1990 population is 14,867.

Mitchell County

Mitchell was formed in 1861 from Yancey, Watauga, Caldwell, Burke and McDowell Counties. It was named in honor of Dr. Elisha Mitchell, a professor at the University of North Carolina. While on an exploring expedition of Mt. Mitchell, the highest peak east of the Mississippi River, Dr. Mitchell fell and was killed. He was buried on the top of this lofty mountain. Located in the western part of the state, Mitchell County is northeast of Asheville and is crossed by U.S. Highway 19E and State Highway 80. The County covers 222 square miles and the 1990 population is 14,433.

Yancy County

Yancy was formed in 1833 from Burke and Buncombe. It is named in honor of Bartlett Yancey, and eloquent orator, many times a member of the Legislature, speaker of the State Senate, and member of Congress. He was also one of the earliest advocates of the public school system in North Carolina. It is in the western section of the State and is bounded by the state of Tennessee and Mitchell, McDowell, Buncombe and Madison Counties. The area is 312 square miles and the 1990 population was 15,419.

II. COUNTY THOROUGHFARE PLANNING PRINCIPLES

Purpose of Planning

There are many benefits to be gained from thoroughfare planning, but the main objective is to assure that the road system will be progressively developed to serve future travel desires adequately. Thus, the main consideration in thoroughfare planning is to make provisions for street and highway improvements so that, when the need arises, feasible opportunities to make improvements exist.

Streets, roads, and highways have two primary functions: they provide traffic service and land service. When combined, these two services are basically incompatible. This conflict will not be serious if both traffic and land service demands are low. However, when traffic volumes are high, access conflicts created by uncontrolled and intensely used abutting property results in intolerable traffic flow friction and congestion.

There are two major benefits derived from thoroughfare planning. First, each road or highway can be designed to perform a specific function and provide a specific level of service. This permits savings in right-of-way, construction, and maintenance costs. It also protects residential neighborhoods and encourages stability in travel and land use patterns. Second, local officials are informed of future improvements and can incorporate them into planning and policy decisions. This will permit developers to design subdivisions in a non-conflicting manner, direct school and park officials to better locate their facilities, and minimize the damage to property values and community appearance that is sometimes associated with road improvements.

Region\County Thoroughfare Planning Concept

The underlying concept of the thoroughfare plan is to provide a functional system of streets, roads, and highways that permit direct, efficient, and safe travel. Different elements in the system are designed to have specific functions and levels of service, thus minimizing the traffic and land service conflict.

In the region\county plan, elements are designated as either urban or rural. In the urban planning area, the local municipality generally has planning jurisdiction. Outside the urban planning area, the county has planning jurisdiction. In those urban areas where no urban thoroughfare plan has been developed, elements are generally designated as rural and under the planning jurisdiction of the region\county. When a thoroughfare plan is developed for an urban area that has not previously had a plan, then the

area defined by that plan is considered to be urban and comes under the planning jurisdiction of the municipality.

Within the urban and rural systems, thoroughfare plan elements are classified according to the specific function they are to perform. A discussion of the elements and functions of the two systems follows.

Urban Thoroughfare Classification System

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets. The major thoroughfares are the primary traffic arteries of the urban area providing for traffic movements within, around and through the area. Minor thoroughfares are designed to collect traffic from the local access streets and carry it to the major thoroughfare system. Local access streets, which may be further classified as residential, commercial, or industrial streets, are designed only to provide access to abutting property. Due to the limited amount of detail that can be shown on a county thoroughfare plan, only urban major thoroughfares are shown.

The coordinated system of major thoroughfares that is most adaptable to the desired lines of travel within an urban area is the radial-loop system. The radial-loop system includes radials, crosstowns, loops, and bypasses. Radial thoroughfares provide for tavel from points outside to major destinations inside the urban area. Crosstown thoroughfares provide for traffic movement across the central area and around the central business district (CBD). Loop thoroughfares provide for lateral travel movements between suburban areas. Bypasses are designed to carry non-local traffic around and through the area. Occasionally, a bypass with low through traffic volumes can be designed to function as a portion of the urban loop. Figure 2 illustrates the concepts of the radial-loop major thoroughfare system and the functionally classified urban street system.

Rural Thoroughfare Classification System

The rural system consists of those facilities outside the urban thoroughfare planning boundaries. They are classified into four major systems: principal arterials, minor arterials, major and minor collectors, and local roads. Table 1 indicates generally accepted statewide mileage on these systems.

IDEALIZED THOROUGHFARE PLAN

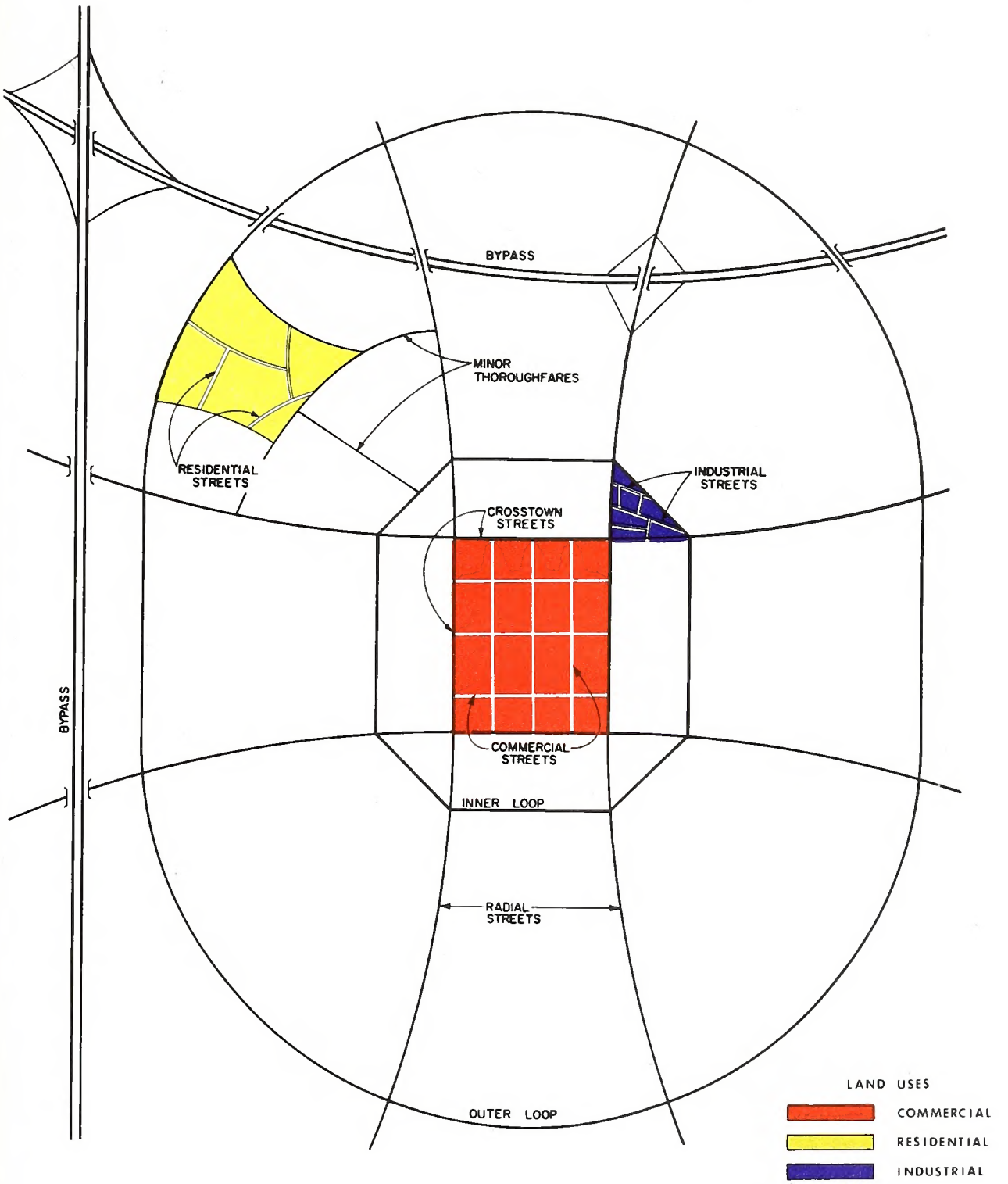


FIGURE 2

TABLE 1	
Rural System Road Mileage Distribution	
Systems	Percentage of Total Rural Miles
Principal Arterial System	2-4
Principal Arterial System plus Minor Arterial Road System	6-12
Collector (Major and Minor) Road System	20-25
Local Road System	65-75

Rural Principal Arterial System: This system consists of a connected network of continuous routes that serve corridor movements having substantial statewide or interstate travel characteristics. This will be indicated by both the trip lengths and the travel densities. The principal arterial system should serve all urban areas of over 50,000 population and a majority of those with a population greater than 5,000. The Interstate system constitutes a significant portion of the principal arterial system.

Rural Minor Arterial System: This system, in conjunction with the principal arterial system, forms a network that links cities, larger towns, and other major traffic generators such as large resorts. The minor arterial system generally serves interstate and intercounty travel and travel corridors with trip lengths and travel densities somewhat less than the principal arterial system.

Rural Collector Road System: The rural collector routes generally serve intracounty travel rather than statewide travel. This system consists of those routes on which the predominant travel distances are shorter than on the arterial routes. The rural collector road system is subclassified into major and minor collector roads.

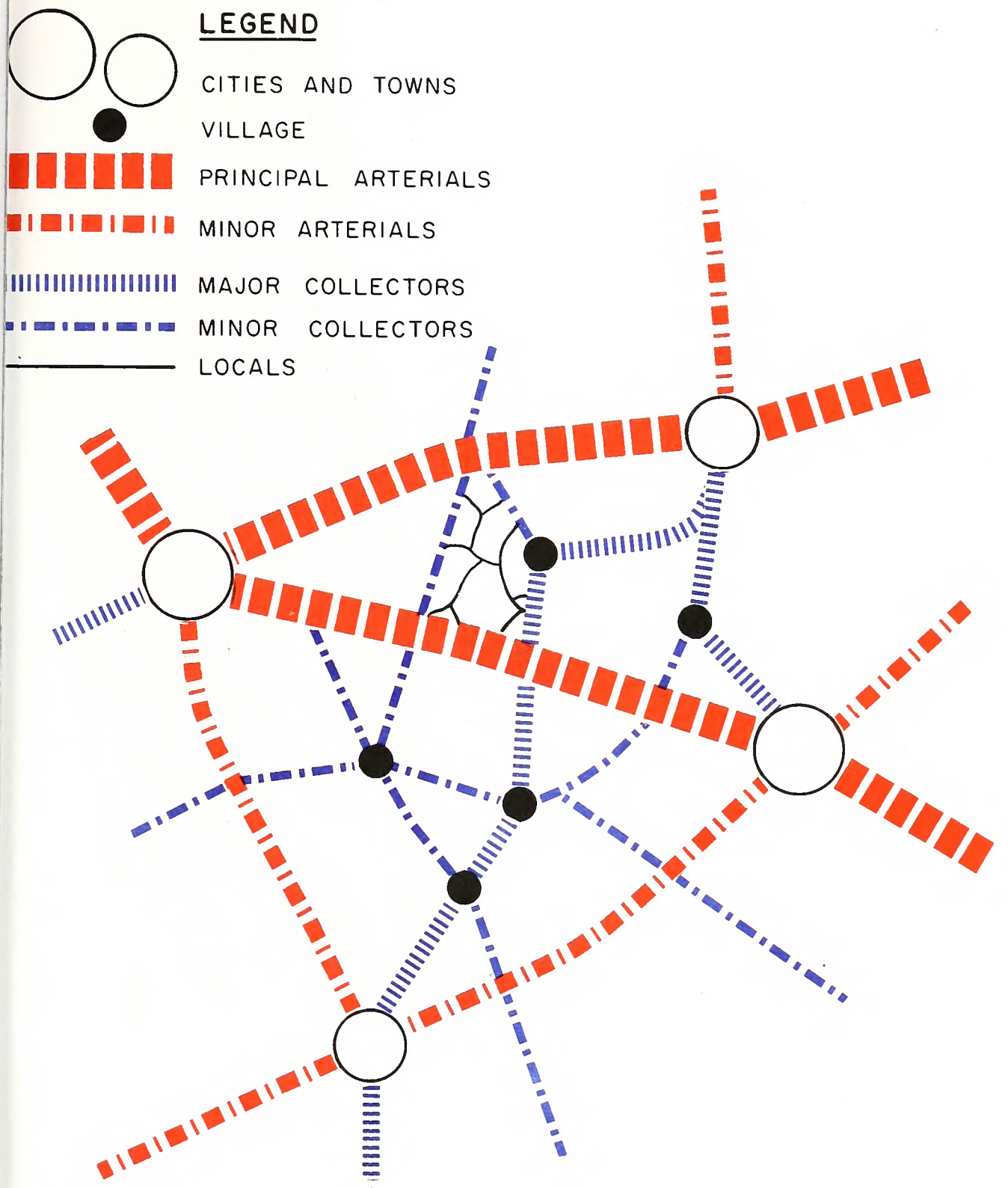
Major Collector Road: These routes provide service to the larger towns not directly served by the higher systems and to other traffic generators of equivalent intracounty importance, such as consolidated schools, shipping points, county parks, significant mining and agricultural areas, etc. Major collector roads also link these places to routes of higher classification and serve the more important intracounty travel corridors.

Minor Collector Roads: These routes collect traffic from local roads and bring all developed areas within a reasonable distance of a major collector road; provide service to the remaining smaller communities; and link the locally important traffic generators with the rural outskirts.

Rural Local Road System: The local roads are comprised of all roads that are not on a higher system. Local residential subdivision streets and residential collector streets are elements of the local road system. Local residential streets are either cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares or serve major traffic generators and do not collect traffic from more than one hundred dwelling units. Residential collector streets serve as the connecting street system between local residential streets and the thoroughfare system.

Figure 3 gives a schematic illustration of a functionally classified rural highway system. Figure 4 shows the functional classification of the major roads in Region D.

FIGURE 3



SCHEMATIC ILLUSTRATION
OF FUNCTIONALLY CLASSIFIED
RURAL HIGHWAY NETWORK

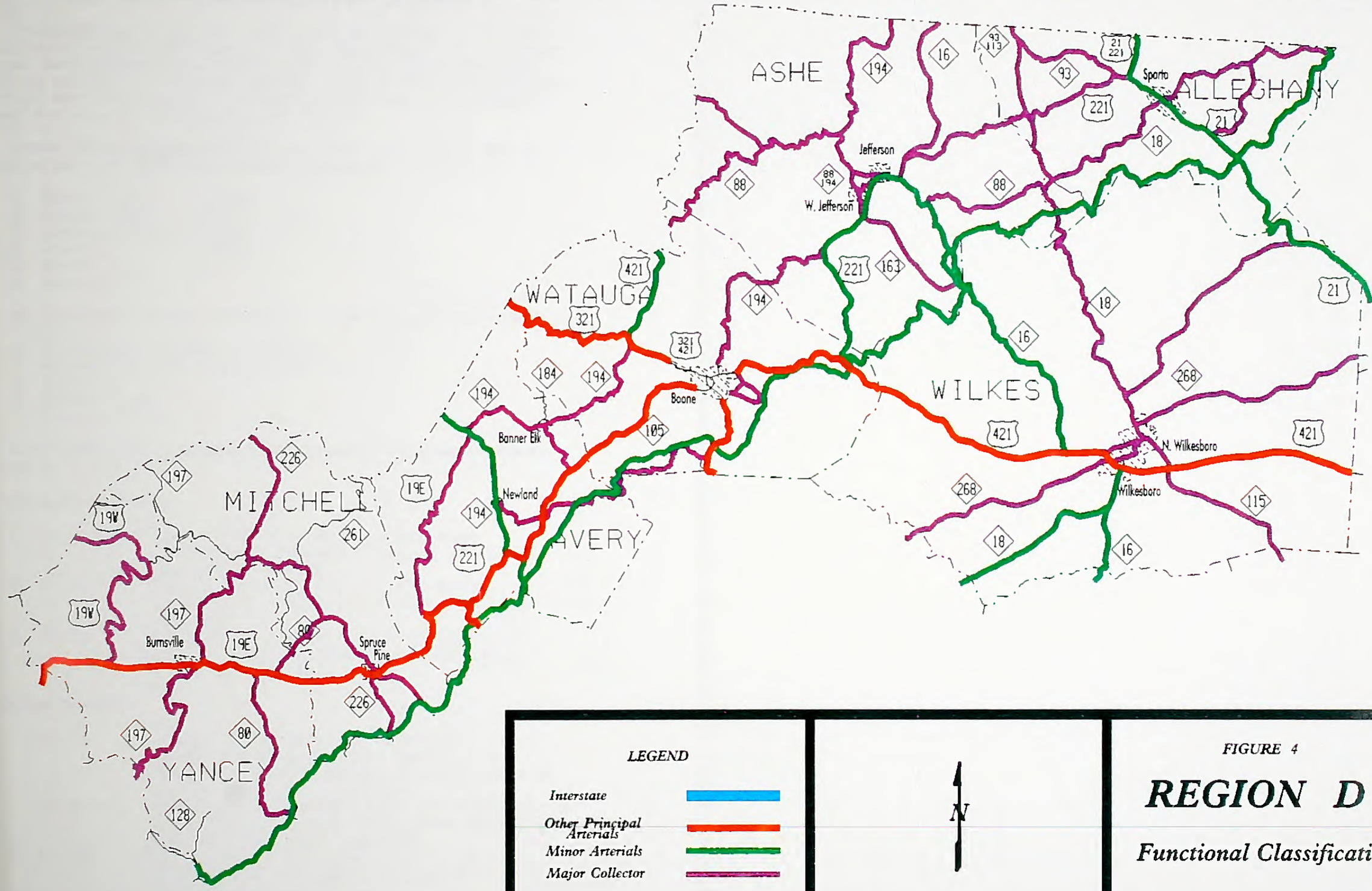


FIGURE 4

REGION D

Functional Classification

III. URBAN THOROUGHFARE PLANS IN REGION D

Thoroughfare plans are developed for urban areas and counties to assist officials in the development of the most logical and appropriate street system that will meet the existing and future travel demands. The municipalities and counties must cooperate as a team to develop an efficient system for travel throughout the region.

Urban Thoroughfare Plans that have been completed in Region D and the year they were completed:

1. Banner Elk (1986)
2. Spruce Pine (1977)
3. Watauga County (1982)
4. Sparta (1992)
5. Boone (1991)
6. Burnsville

Thoroughfare Plans underway at the time of this report:

1. Jefferson and West Jefferson
2. Wilkesboro and North Wilkesboro
3. Newland
4. Spruce Pine
5. Blowing Rock

1992-1998 Transportation Improvement Program Projects for Region D are:

Alleghany County

1. US 21-221	Twin Oaks to Virginia State Line. (3.4 Miles) Upgrade Existing Two Lane Facility (R-2302)
2. US 21	Sparta to US 21-211 in Twin Oaks. (2.5 Miles) Upgrade Existing Facility. (R-2302)
3. NC 18	Blue Ridge Parkway South of Citron to Sparta. (13.4 Miles) Upgrade Existing Facility. (R-2523)

Ashe County

1. NC 16	Wilkes County Line to Jefferson. (10.0 Miles) Improve Two Lane Roadway, Add Guardrail and Construct Passing Lanes at Three Locations. (R-2100)
2. NC 88-194	Watauga County Line to US 221 Business in Jefferson. (7.5 Miles) Upgrade Existing Two Lane Facility. (R-2563)
3. US 221	NC 16 to the Alleghany County Line. (9.8 Miles) Upgrade Existing Facility. (R-2310)

Wilkes County

1.	NC 16	US 421 to Ashe County Line. (13.1 Miles) Upgrade Existing Two Lanes and Add Climbing Lanes. (R-2207)
2.	NC 18	NC 90 at Lenoir to NC 16 at Moravian Falls. (23.0 Miles) Improve and Upgrade Existing Facility with Some Relocation. (R-2101)
3.	NC 18	NC 268A to SR 1002. (1.4 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2517)
4.	NC 18-268	Wilkesboro-North Wilkesboro Bypass, NC 18 to US 421. (3.6 Miles) Two Lanes on Four Lane Right of Way, Part on New Location. (R-616)

Watauga County

1.	NC 105	NC 181 to SR 1107 in Boone. (14.6 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2566)
2.	NC 194	Banner Elk in Avery County to Valle Crucis Watauga County. Widen and Resurface Existing Roadway. (R-2710)
3.	US 321	North of 268 to Existing Multi-Lanes North of Blowing Rock. (15.3 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2237)
4.	US 421	Boone to 2 Miles East of US 221. (11.9 Miles) Four Lane Divided Facility on New Location. (R-529)
5.	US 421-321	Tennessee State Line to US 221 in Boone. (13.6 Miles) Widen Existing Roadway to Multi-Lane Facility. (R-2615)

Avery County

1.	US 19E/ NC 194	Multi-Lane Section East of Spruce Pine to US 221. (10.3 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2520)
2.	NC 105	NC 181 to SR 1107 in Boone. (14.6 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2566)

Mitchell County

1.	US 19 E	US 19W to Multi-Lane Section West of Spruce Pine. (18.4 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2519)
2.	US 19E NC 194	Multi-Lane Section East of Spruce Pine to US 221. (10.3 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2520)

3.	NC 226	Spruce Pine Bypass, US 19 to Mimpro. (1.5 Miles) Four Lanes on New Location. (R-2119)
4.	NC 226	Blue Ridge Parkway to US 19E. (4.7 Miles) Upgrade Existing Two Lane Roadway. (R-2598)

Yancy County

1.	US 19	US 23 to US 19W. (11.3 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2518)
2.	US 19 E	US 19W to Multi-Lane Section West of Spruce Pine. (18.4 Miles) Widen Existing Roadway to a Multi-Lane Facility. (R-2519)

IV. POPULATION, LAND USE, AND TRAFFIC

Factors Affecting Transportation

The objective of thoroughfare planning is to develop a system of transportation that will enable people and goods to travel safely and economically. To determine the needs of Region D or the individual Counties, the factors of population, land use, and traffic must be examined. To plan for the transportation needs of the Region, it is important to understand and describe the type and amount of travel that takes place in the area, and also to clearly identify the goals and objectives to be met by the thoroughfare plan.

To fulfill the objective of an adequate thirty year thoroughfare plan, reliable forecasts of future travel characteristics must be made. Such forecasts are possible only when the following major items are carefully analyzed: (1) historic and potential population changes; (2) significant trends in the economy; (3) the character and intensity of land development; and (4) motor vehicle registration and use. Additional items that vary in influence include the effects of legal controls such as zoning ordinances and subdivision regulations, availability of public utilities and transportation facilities, and topogaphic and other physical features of the area.

Population Trends

The volume of traffic on a section of roadway is a function of the size and location of the population it serves. An analysis of the population is one of the first steps for a transportation planner. The analysis of past trends allows the planner to estimate future population and traffic that it will generate with some degree of reliability.

For Region D the population growth trends for each county were analyzed from 1970 to 1990. Over this period Alleghany, Avery and Mitchell counties have seen little or no growth. Ashe County over this same period has seen negative growth. Wilkes and Yancy counties have seen slight growth. Only Watauga county has experienced significant growth. Future county population projections are made by the Office of State Planning in Raleigh. According to their projections all the counties in Region D with the exception of Watauga and Yancy are anticipated to have a decrease in population from their 1990 population.

Table 2 shows historical and projected populations for all of the Region D counties..

TABLE 2

Historical and Projected Populations of Counties within Region D

County	1970	1980	1990	2000*	2010*	2020*
Alleghany	8,134	9,587	9,590	9,478	9,178	8,747
Ashe	19,571	22,325	22,209	21,996	21,290	20,154
Avery	12,655	14,409	14,867	15,034	14,784	14,262
Mitchell	13,447	14,428	14,433	14,338	13,937	13,410
Watauga	23,404	31,666	36,952	40,631	43,611	46,230
Wilkes	49,524	58,657	59,393	59,630	58,172	55,677
Yancy	12,629	14,934	15,419	15,832	15,802	15,499

* Projections made by the Office of State Budget and Management

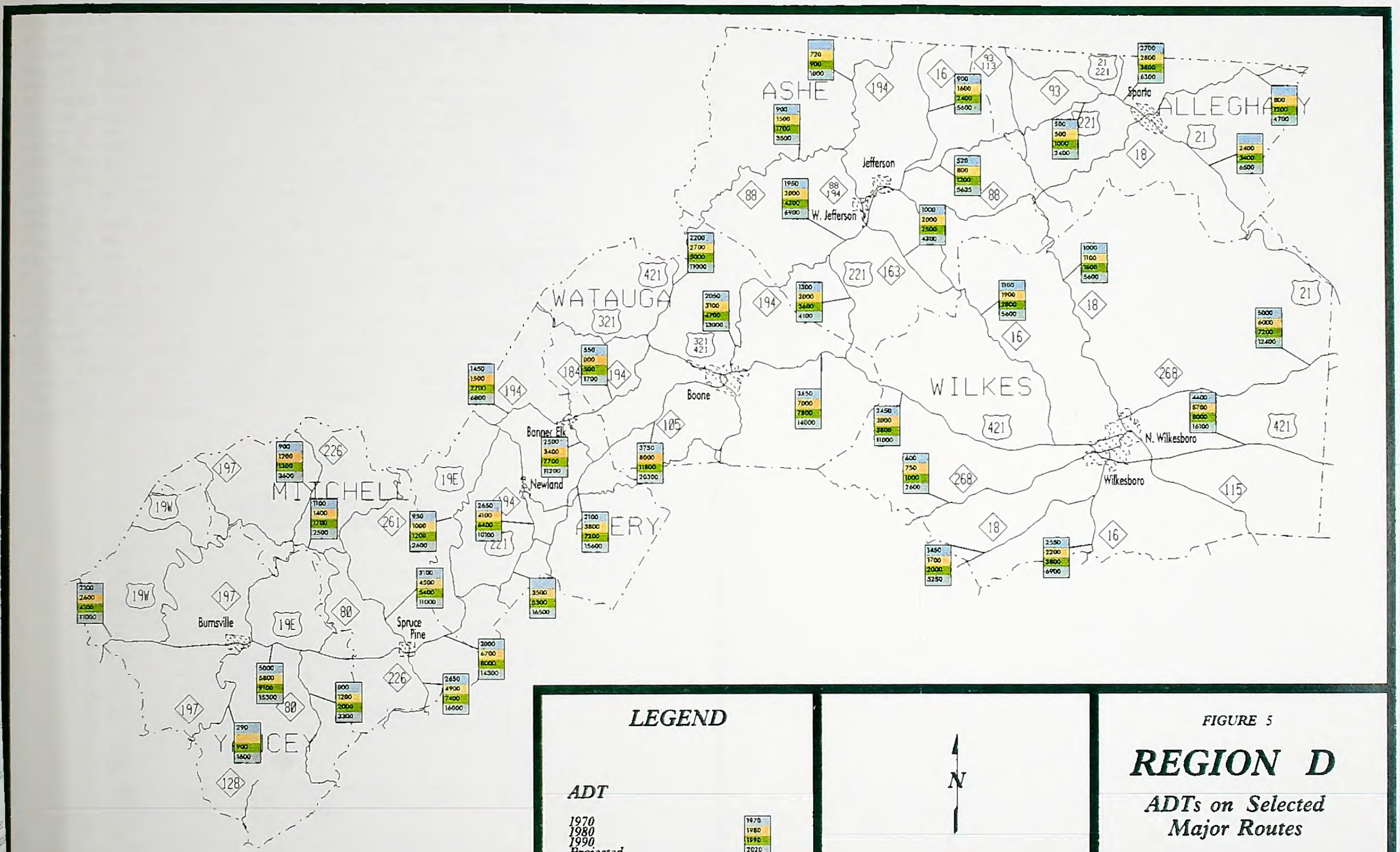
Land Use

The generation of traffic on a particular thoroughfare is very closely related to the use of adjacent land areas. Some types of land uses generate much more traffic than others. For example, a commercial or retail area such as a shopping center will generate (or attract) much larger volumes of traffic than a residential area. The attraction between different land uses varies with the intensity of development and the distance between those developed areas. Therefore, it becomes necessary to designate land uses by type for transportation planning. An analysis of the distribution of existing land uses serves as a basis for forecasting future land use needs and the resulting travel patterns.

Traffic

A comparison of 1970, 1980, and 1990 average annual daily traffic volumes (ADT) on selected major roads and highways in Region D is shown in Figure 5. Also shown are projections for the year 2020, assuming no changes to the existing street system are made. These projections were based on historical and anticipated population and economic growth patterns and land use trends.

Vehicle registration has increased at a much greater rate than population since 1940. This increase can be shown best by a graph depicting the change in persons per vehicle ratio over time. This ratio is obtain by dividing the total


ASHE
ALLEGHANY
WATAUGA
WILKES
MITCHELL
AVERY
YANCEY
Jefferson
W. Jefferson
Sparta
Boone
Banner Elk
Newland
Burnsville
Spruce Pine
N. Wilkesboro
Wilkesboro
LEGEND
ADT
1970
1980
1990
Projected
N
FIGURE 5
REGION D
ADTs on Selected Major Routes

population of the area by the total number of vehicles registered in that area. Figure 6 thru Figure 12 shows this comparison for North Carolina and each county within Region D and includes projections to the year 2010. the results illustrate the transition from non-automobile oriented society to one whose vitality is heavily dependent on the automobile. This change in lifestyle has gradually occurred over many years, with the most dramatic difference being between 1940 and 1960. This is primarily due to: the post-depression increase in the standard of living; the increase in population including the post World War II "Baby Boom"; the transition from an agriculturally dominated society to a more diversified one (fewer people on the farm, greater need for transportation); and the availability of automobiles in the 1960's and 1970's and the banking credit to buy them. Since the 1970s, these reasons for purchasing more automobiles have had less influence and have led to the expectation that the person-per-vehicle rate will begin to stabilize as projected in Figures 6 thru 12. This saturation effect is expected to stabilize trip-making characteristics of middle and upper income families since the already have the financial means to purchase enough vehicles to satisfy their transportation needs. On the other hand, moderate growth in the trip-making characteristics of lower income families is projected due to an expected improvement in their financial well-being.

FIGURE 6

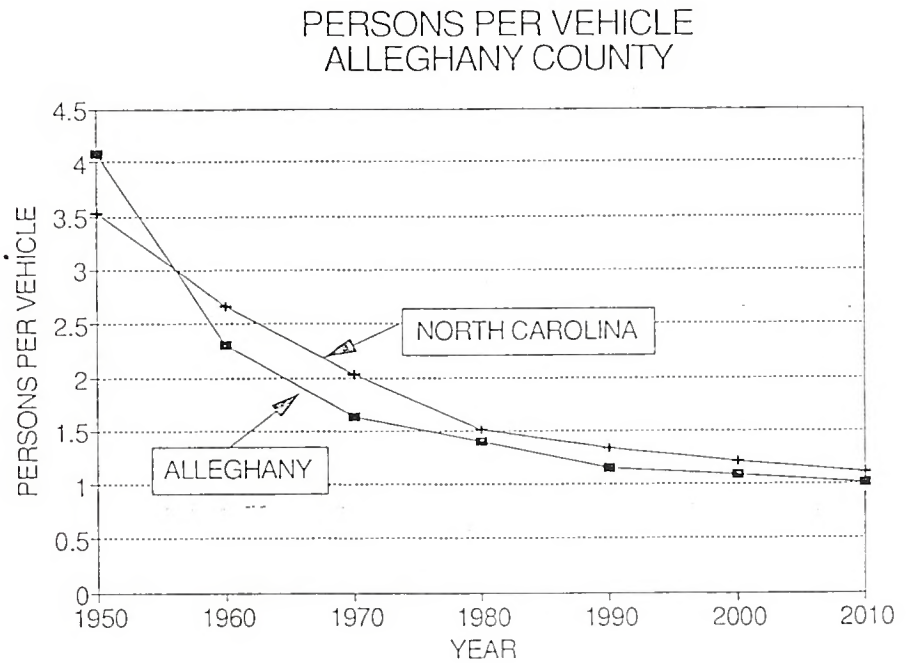


FIGURE 7

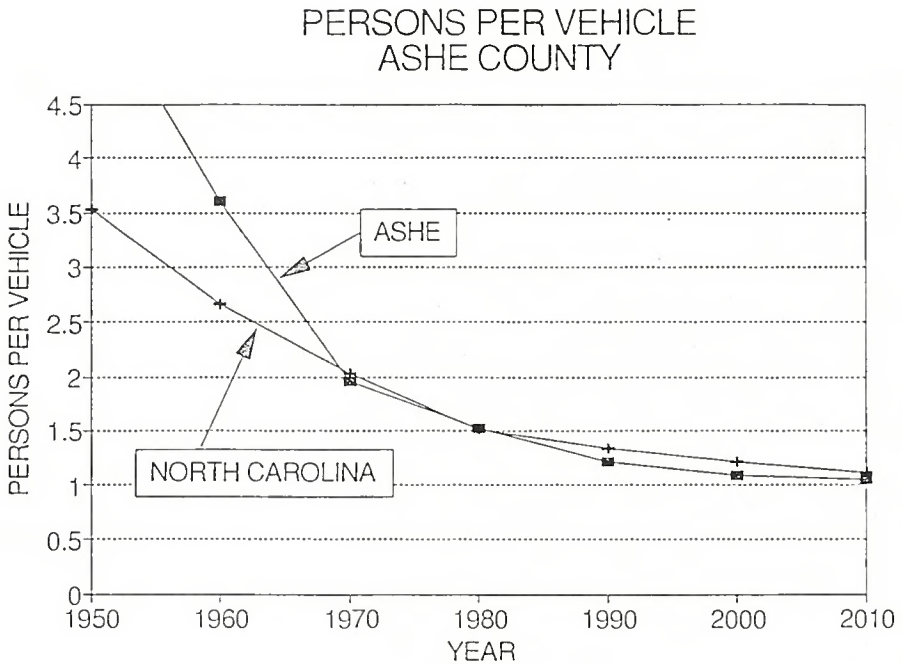


FIGURE 8

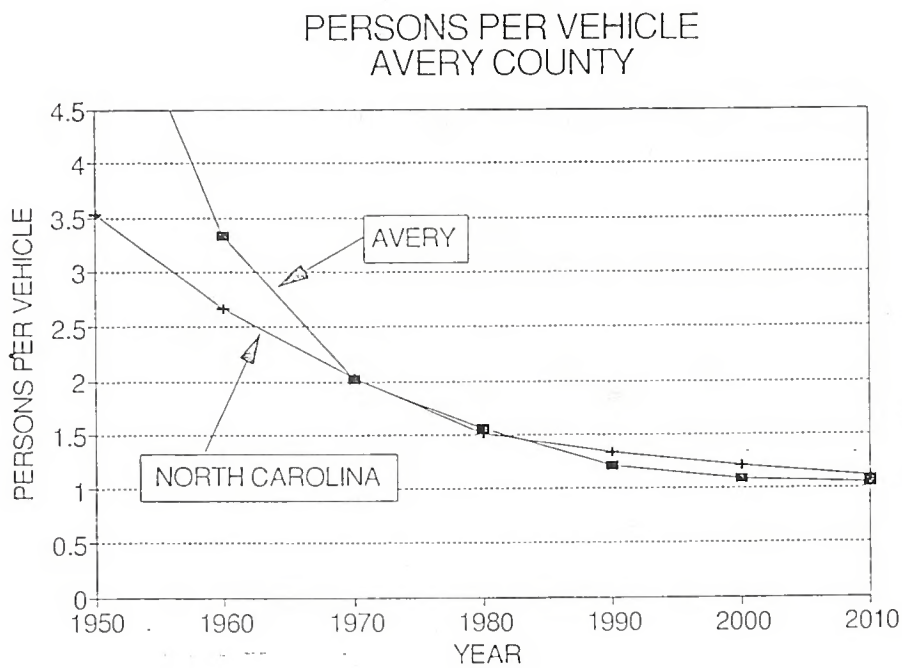


FIGURE 9

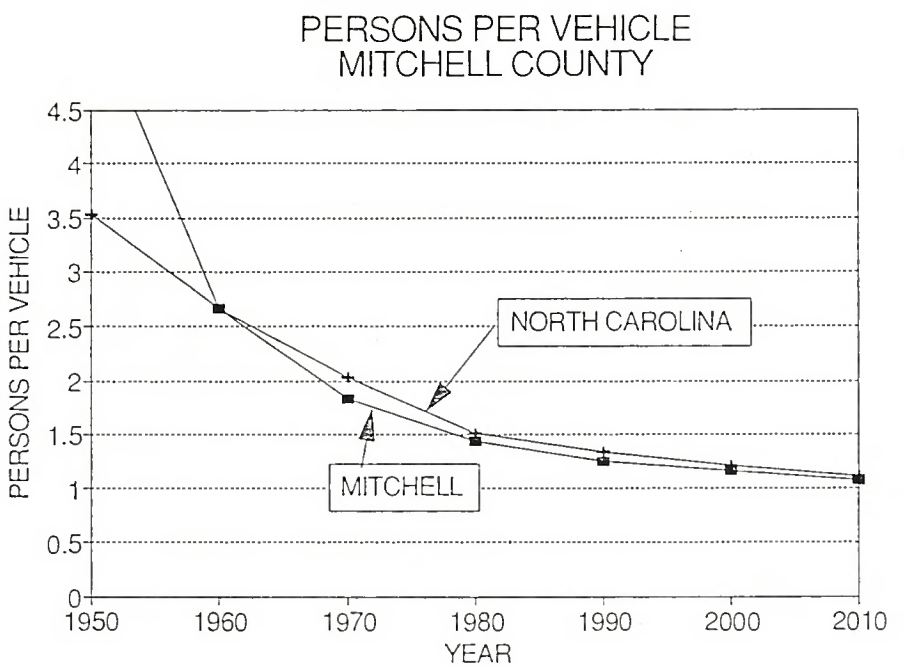


FIGURE 10

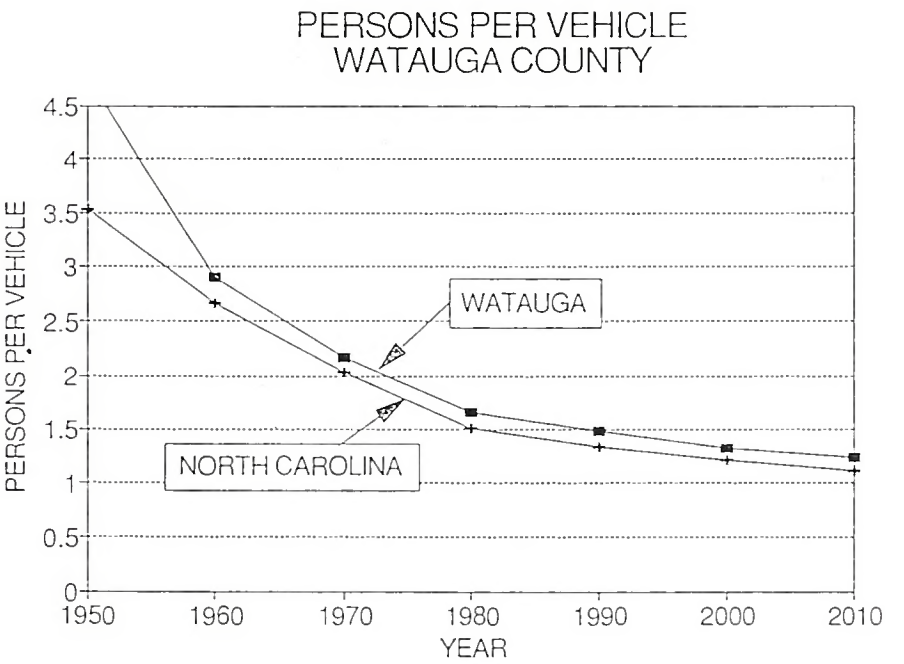


FIGURE 11

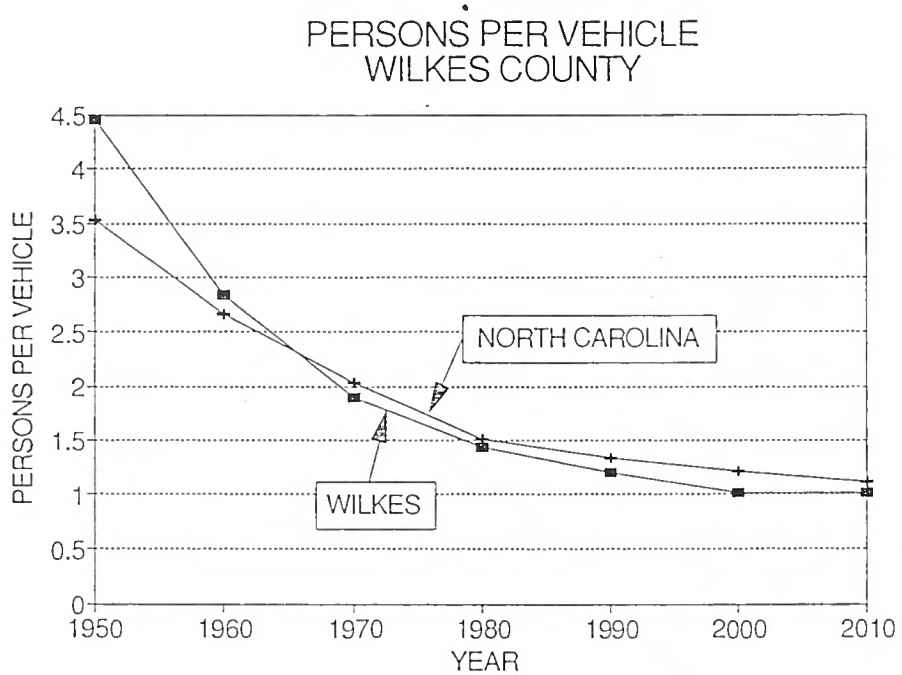
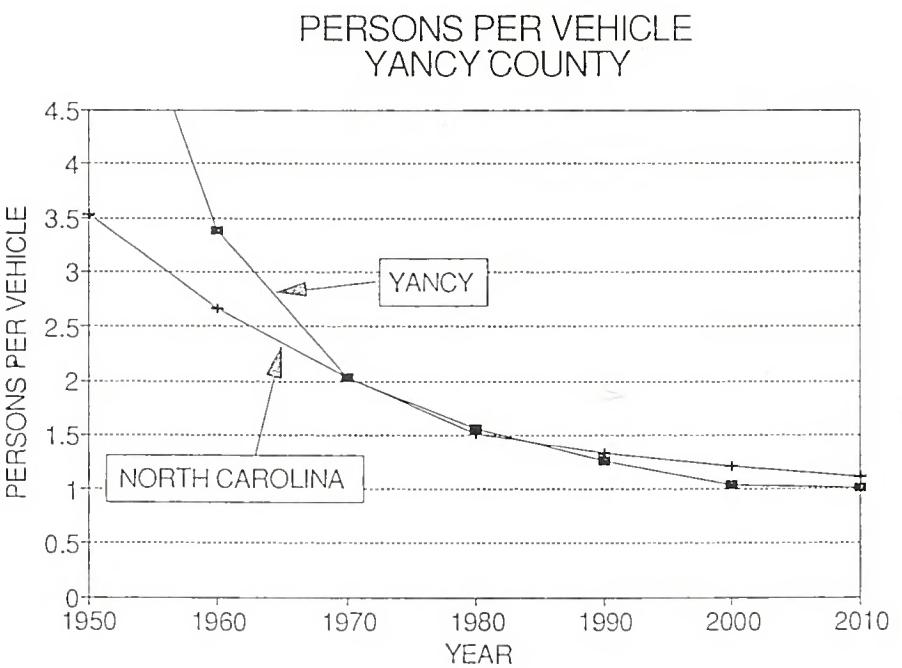


FIGURE 12



V. TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM

This chapter presents an analysis of the ability of the existing highway system to serve the region's travel desires. Emphasis is placed not only on detecting the deficiencies, but on understanding their cause. Travel deficiencies may be localized and the result of substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by a system deficiency such as a need for a bypass, loop facility, construction of missing links, or additional routes connecting cities.

Existing Travel Patterns

An indication of the adequacy of the existing street system is a comparison of traffic volumes versus the ability of the streets to move traffic. In a rural area, a street's ability to move traffic is generally controlled by the physical design of the road, the amount and character of traffic control devices, the influence and character of traffic generated by abutting property, and the imposed speed restrictions.

Capacity is the maximum number of vehicles which has a "reasonable expectation" of passing over a given section of a roadway, during a given time period under prevailing roadway and traffic conditions. The relationship of traffic volumes to the capacity of the roadway will determine the **level of service (LOS)**. Six levels of service identify the range of possible conditions. Figure 13 shows the levels of congestion associated with the various levels of service. Table 3 give a brief description of each LOS in accordance with the 1985 Highway Capacity Manual.

The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing facilities, and LOS C on new facilities. LOS D is considered the "**practical capacity**" of a facility, or that at which the public begins to express dissatisfaction.

Design requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each road or highway section must be individually analyzed and its design requirements determined by the amount and type of projected traffic, existing capacity, desired level of service, and available right of way. For driver convenience, ease of operation, and safety, it would be desirable to widen all existing roads and highway to provide a minimum lane width of 12 feet. However, when considering overall statewide needs and the available highway revenue, it is found that these levels of improvement applied statewide would be impractical. Therefore, it is necessary to

establish minimum tolerable widths for existing roads with respect to traffic demands that would be economically feasible. The widths used in determining the existing lane deficiencies in the County are given in Table 4.

Table 3

LEVEL OF SERVICE

LOS A - describes primarily free flow conditions. The motorist experiences a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed. On an urban arterial, LOS A corresponds to a average travel speed of 25 to 35 mph.

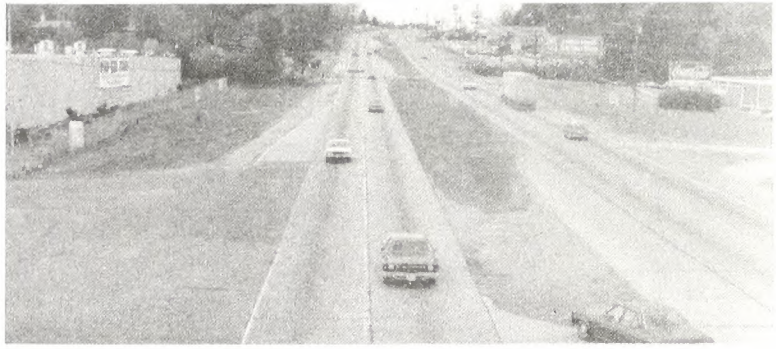
LOS B - also represents reasonably free flow conditions. The ability to maneuver within the traffic stream is only slightly restricted.

LOS C - provides for stable operations, but flows approach the range in which small increases will cause substantial deterioration in service. Freedom to maneuver is noticeably restricted. Minor incidents may still be absorbed, but the local decline in service will be great. Queues may be expected to form behind any significant blockage.

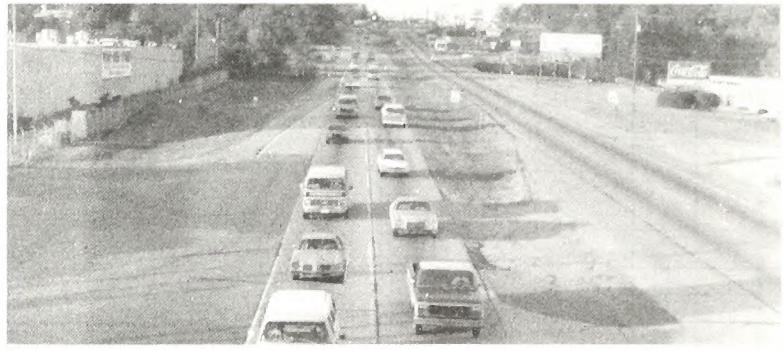
LOS D - borders on unstable flow. Small increases in flow can cause substantial deterioration in service. Freedom to maneuver is severely limited, and the driver experiences drastically reduced comfort levels. Minor incidents can be expected to create substantial queuing. On an urban arterial, LOS D corresponds to an average travel speed of 9 to 17 mph.

LOS E - The boundary between LOS D and LOS E describes operation at **capacity**. Operations at this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or changing lanes, requires the following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate any disruption. Any incident can be expected to produce a serious breakdown with extensive queuing.

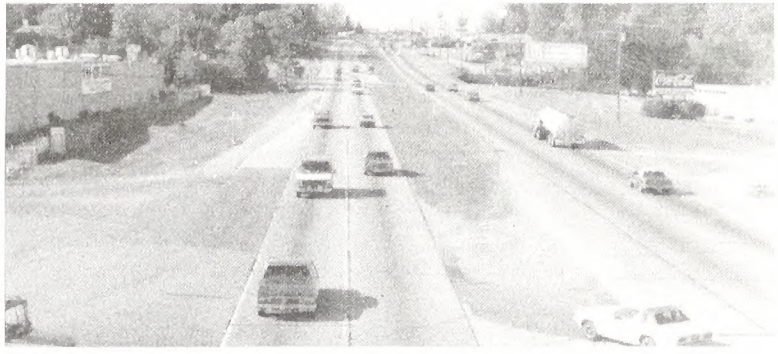
LOS F - describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points.



LEVEL OF SERVICE - A

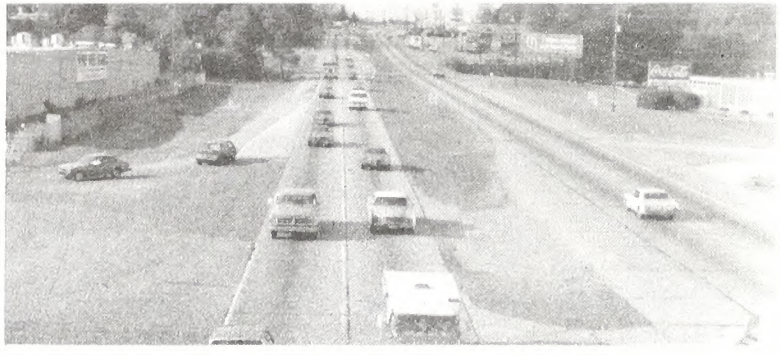


LEVEL OF SERVICE - D



LEVEL OF SERVICE - B

LEVEL OF SERVICE - E



LEVEL OF SERVICE - C

LEVEL OF SERVICE - F

LEVELS OF SERVICE

FIGURE 13

TABLE 4

Minimum Tolerable Lane Widths (in feet)

ADT	Principal Arterials	Minor Arterials	Collectors
over 2,000	11	11	11
400 - 2,000	-	10	10
100 - 400	-	10	9
below 100	-	-	9

Capacity Analysis

Capacity Deficiencies - Figure 14 depicts the base year (1990) major route system, and the **ADT** (Average Daily Traffic). A comparison of the design year ADT to capacities reveals several streets near or over practical capacity (LOS D). These areas are highlighted in Figure 14, and include:

Wilkes County

NC 268 from SR 1957 to NC 18. This is a two lane section that varies from 20 feet wide at SR 1957 to 40 feet wide at NC 18. The capacity of this section of road is 12,000 vpd and it is currently carrying 14,000 vpd.

NC 18 from Mulberry south past NC 115 into downtown Wilkesboro. From Mulberry to NC 268 this facility is two lane from 18 to 20 feet wide. Once beyond NC 268 it widens to 24 feet. The current traffic volume along this section of NC 18 is 13,400 vpd. It has a capacity of 12,000 vpd.

US 421 from NC 16/18 to NC 16 west of Wilkesboro. This section of US 421 has a large amount of strip development and some stops lights which contribute to its capacity problems. Currently it is carrying 15,500 vpd with a capacity of 13,000 vpd.

NC 16 from US 421 north to SR 1315. This is a two lane 24 foot wide facility that is carrying 8,200 vpd and has a capacity of 12,000 vpd. This section is expected to approach capacity in the near future.

Watauga County

NC 194 from US 421 north to SR 1350. NC 194 is a two lane 18 foot wide facility that is currently carrying 6,200 vpd and has a capacity of 9,000 vpd.

US 421 from SR 1655 west to US 321. This section of highway is two lanes and varies in width from 24 feet to 33 feet wide. Its current capacity is 13,000 vpd from SR 1655 to Jefferson Road and 20,000 vpd from Jefferson Road to US 301. The average daily traffic volumes on this section vary from 14,000 vpd to 24,000 vpd respectively. For a more detailed discussion of this area see the May 1, 1991, Boone Thoroughfare Plan.

US 321 from US 421 south to NC 105. US 321 in this location is a four lane 64 feet wide facility that has a capacity of 28,000 vpd. Currently 21,000 vpd use this section of roadway. For a more detailed discussion of this area see the May 1, 1991, Boone Thoroughfare Plan.

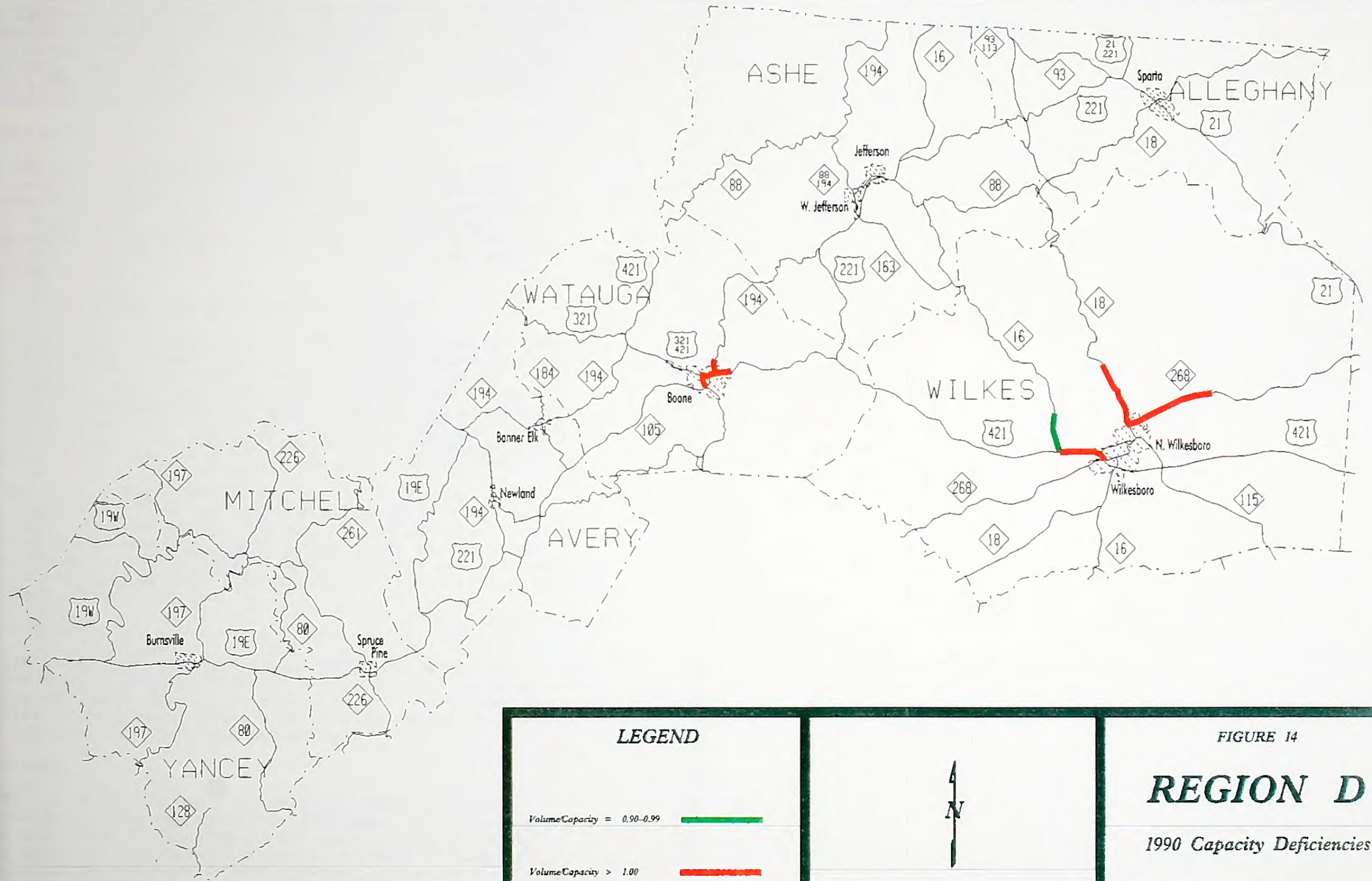


FIGURE 14

REGION D

1990 Capacity Deficiencies

Avery County

NC 184 from NC 105 north to NC 194. This section of road services a couple of ski resorts along with the town of Banner Elk from NC 105. It is two lane 20 - 22 feet wide facility currently carrying 7,700 vpd and has a capacity of 11,000. Additional Tourism development is expected along this section.

Mitchell County

NC 226 from Blue Ridge Parkway north to US 19E. This section or roadway is the primary route into Mitchell County from I-40 to the south. The Town of Spruce Pine is also encouraging additional residential and retail development in this area. NC 226 is a 2 lane 24 foot wide facility that currently has a capacity of 13,000 vpd and carries 7,400 vpd.

Width, and Alignment Deficiencies

North Carolina's standard for highway construction calls for 11 foot lanes on all highway with traffic volumes greater than 2000 ADT (Average Daily Traffic) or design speeds greater than 50 miles per hour. This includes all primary arterials. A minimum lane width of 9 feet can be tolerated on collector roads with an ADT of less than 4300 vehicles per day. The minimum level of service for minor collector roads dictates a 40 mph design speed during peak traffic conditions.

There are a number of major roads in the Region that have substandard widths. The standards established in Table 4 were used in the analysis. Because of the substantial cost of upgrading all secondary roads to standard, narrow widths may have to be tolerated until sufficient funds are available for improvements. The roads throughout the region that have substandard widths include:

Mitchell County

NC 226 - From the Bridge in Spruce Pine North to the Pisgah National Forest boundary. This section is very narrow and curvy with a considerable amount of truck traffic. Safety improvement such as widening to 24 feet and improved shoulders are needed here.

Yancy County

NC 80 - From US 19E south to SR 1157. This roadway currently carries approximately 2200 vpd, by the design year 2020 this is expected to increase to approximately 3300 vpd. The existing facility is 2 lanes 18 feet wide and should be improved to the minimum 22 feet with improved shoulders. (R-2599)

Avery County

NC 194 - From Elk Park to Banner Elk. This facility is 2 lanes 20 feet wide with no shoulders. The current traffic volume is 3,100 vpd. By 2020 this volume is expected to increase to 6,800 vpd. It is recommended that this section of NC 194 be widen to 24 feet with improved shoulders.

Watauga County

NC 194 - From SR 1350 to the county line, this is 2 lanes 20 feet wide facility that carries 3,000 vpd. By 2020 the ADT is expected to be 6,300 vpd. This section should be widen to 24 feet and the shoulderes improved.

Ashe County

NC 88 - From Creston to its intersection with NC 194. The existing 2 lane 20 foot wide facility carries 2,400 vpd. Widening is recommended to 2 lanes 24 feet that can carry anticipated 3,500 vpd in 2020. (R-2563, Scheduled for ROW Protection)

US 221 - From NC 16 to SR 1571. Existing section is 2 lanes 20 feet wide and carries 2,100 vpd. In 2020 this is expected to be 5,600 vpd. Widen to 2 lane 24 feet wide. (R-2310, Scheduled for ROW Protection)

Alleghany County

US 21 - From NC 18 in Sparta to Wilkes County line. The existing roadway is 20 feet wide and has a volume of 4,400 vpd with 5 to 10% of this traffic being large trucks. By the year 2020 the volume is expected to increase to 6,500 vpd. This facility should be widened to 2 lanes 24 feet.

NC 18 - From NC 113 to Surry County Line. Current traffic volumes on this section vary from 1,000 vpd west of Sparta to 3,600 vpd east of Sparta with 5 to 10% of this being truck traffic. The current cross section is 2 lane 20 feet wide with 10 foot grass shoulders. By the design year 2020 traffic volumes are expected to increase to 2,000 vpd and 5,500 vpd respectively. It is proposed that this facility be widened to 24 feet.

Wilkes County

NC 115 - From the county line north to US 412. This route carries a large amount of truck traffic between Wilkesboro-North Wilkesboro and Statesville. It is a 2 lanes 20 feet wide facility with a volume of 2,300 vpd. By 2020 this volume is expected to increase to 5,400 vpd. It is proposed that this section be widen to 24 feet of pavement.

NC 16 - From SR 1557 north to the county line. Widen the existing facility from 20 feet to 24 and improve the shoulders. The current traffic volume is 2,800 vpd with a large amount of this being truck traffic from Wilkesboro to Jefferson - West Jefferson. The traffic volume in 2020 is expected to be 5,600 vpd. (R-2207, Scheduled for ROW Protection)

Traffic Safety

Traffic accident records are of assistance in locating problem areas on the highway system. The Intersection Accident Listing for Region D from January 1, 1988, to March 30, 1992, was used to find intersections within the region with five or more accidents. Those intersections with 15 or more accidents, or whose accident severity or property damage is considerably higher than the average, are called significant high accident locations. There are 11 significant high accident locations in Region D. Listed below are the 11 high accident locations in the Region and the 10 highest accident locations for each county.

TABLE 5

Region D - High Accident Locations

Intersection	Number of Accidents
Alleghany	
US 21 / NC 18	21
Ashe	
US 221 / NC 163	18
Wilkes	
US 421 / NC 16	28
NC 268 / SR 1966	19
Watauga	
US 221 / SR 1514	26
NC 105 / SR 1112	18
US 221 / SR 1357	15
Avery	
US 221 / NC 181	19
US 221 / NC 194	19
US 19E / NC 194	16
Mitchell	
US 19E / NC 226	26

TABLE 6

Yancy County - High Accident Locations

Intersection	Number of Accidents
US 19E / SR 1196	12
US 19E / SR 1186	10
US 19E / SR 1142	9
US 19E / SR 1428	8
NC 197 / SR 1416	7
US 19E / SR 1427	6
US 19E / SR 1438	6
US 19E / SR 1323	5
US 19E / SR 1144	5
US 19E / SR 1136	5
US 19 / SR 1196	5

TABLE 7

Alleghany County - High Accident Locations

Intersection	Number of Accidents
US 21 / NC 18	21
US 21 / BLUE RIDGE PARK.	5

TABLE 8

Ashe County - High Accident Locations

Intersection	Number of Accidents
US 221 / NC 163	18
NC 88 / NC 194	14
NC 88 / SR 1131	12
US 221 / SR 1149	8
NC 16 / SR 1632	6
US 221 / NC 16	6
NC 16 / NC 88	5
NC 16 / SR 1578	5
NC 88 / SR 1153	5
NC 88 / SR 1317	5

TABLE 9	
Wilkes County - High Accident Locations	
Intersection	Number of Accidents
US 421 / NC 16	28
NC 268 / SR 1966	19
NC 115 / SR 2355	14
US 421 / NC 115	13
NC 18 / SR 1194	13
NC 268 / SR 2026	12
NC 16 / SR 2467	12
US 421 / SR 2323	11
NC 16 / SR 1372	11
NC 18 / SR 1532	11
NC 115 / SR 2510	11

TABLE 10	
Watauga County - High Accident Locations	
Intersection	Number of Accidents
US 221 / SR 1514	26
NC 105 / SR 1112	18
US 221 / SR 1357	15
US 221 / SR 1508	12
US 221 / SR 1513	11
US 321 / US 421	11
US 321 / SR 1107	11
NC 105 / SR 1109	11
NC 194 / SR 1306	10
US 321 / NC 194	10

TABLE 11	
Avery County - High Accident Locations	
Intersection	Number of Accidents
US 221 / NC 181	19
US 221 / NC 194	19
US 19E / NC 194	16
NC 184 / NC 194	12
NC 105 / NC 184	12
US 19E / SR 1303	9
US 19E / SR 1106	8
NC 194 / SR 1153	8
US 221 / NC 105	7
NC 194 / SR 1370	7

TABLE 12	
Mitchell County - High Accident Locations	
Intersection	Number of Accidents
US 19E / NC 226	26
NC 226 / SR 1114	13
US 19E / SR 1002	10
NC 226 / SR 1250	8
NC 226 / SR 1119	7
NC 226 / SR 1118	6
US 19E / SR 1236	5
US 19E / SR 1137	5
US 19E / SR 1135	5

Bridge Conditions

Bridges are a vital and unique element of a highway system. First, they represent the highest unit investment of all elements of the system. Second, any inadequacy or deficiency in a bridge reduces the value of the total investment. Third, a bridge presents the greatest opportunity of all potential highway failures for disruption of community welfare. Finally, and most importantly, a bridge represents the greatest opportunity of all highway failures for loss of life. For these reasons, it is imperative that bridges be constructed to the same design standards as the system of which they are a part.

Congress enacted the National Bridge Inspection Program Standards on April 27, 1971, implementing the Federal Highway Act of 1968. These standards require that "all structures designed as bridges located on any of the Federal-Aid Highway Systems be inspected and the safe load carrying capacity computed at regular intervals, not to exceed two years." A sufficiency index number has been calculated for each bridge to establish eligibility and priority for replacement. The bridges with the highest priority are replaced as Federal-Aid funds and State funds are made available.

The North Carolina DOT's Bridge Maintenance Unit, with assistance from various consultants, inspects all bridges on the State Highway System. All bridges in Region D have been analyzed, rated appraised, and inventoried, and the resulting data has been reduced to a more readily usable form as a management tool.

A sufficiency rating was used in the analysis to determine the deficiency of each bridge. The sufficiency rating is a method of evaluating factors that determine whether a bridge is sufficient to remain in service. Factors used include: structural adequacy and safety, serviceability and functional obsolescence, essentiality for public use, type of structure, and traffic safety features. The result of this method is a percentage in which 100 percent represents an entirely sufficient bridge and zero percent represents an entirely insufficient or deficient bridge. A sufficiency rating of 50 percent or less qualifies for Federal Bridge Replacement Funds.

Deficient bridges are categorized as either functionally obsolete or structurally deficient. Bridges in the functionally obsolete category have below average ratings in approach roadway alignment, under clearance, deck geometry, waterway adequacy, or structural condition. Structurally deficient bridges have below average ratings in deck superstructure, substructure, overall structural condition, or waterway adequacy. Table 13 shows the ten most functionally obsolete bridges in region D. Table 14 shows the ten most structurally deficient bridges in Region D. The location of these bridges are shown in red on Figure 15.

TABLE 13

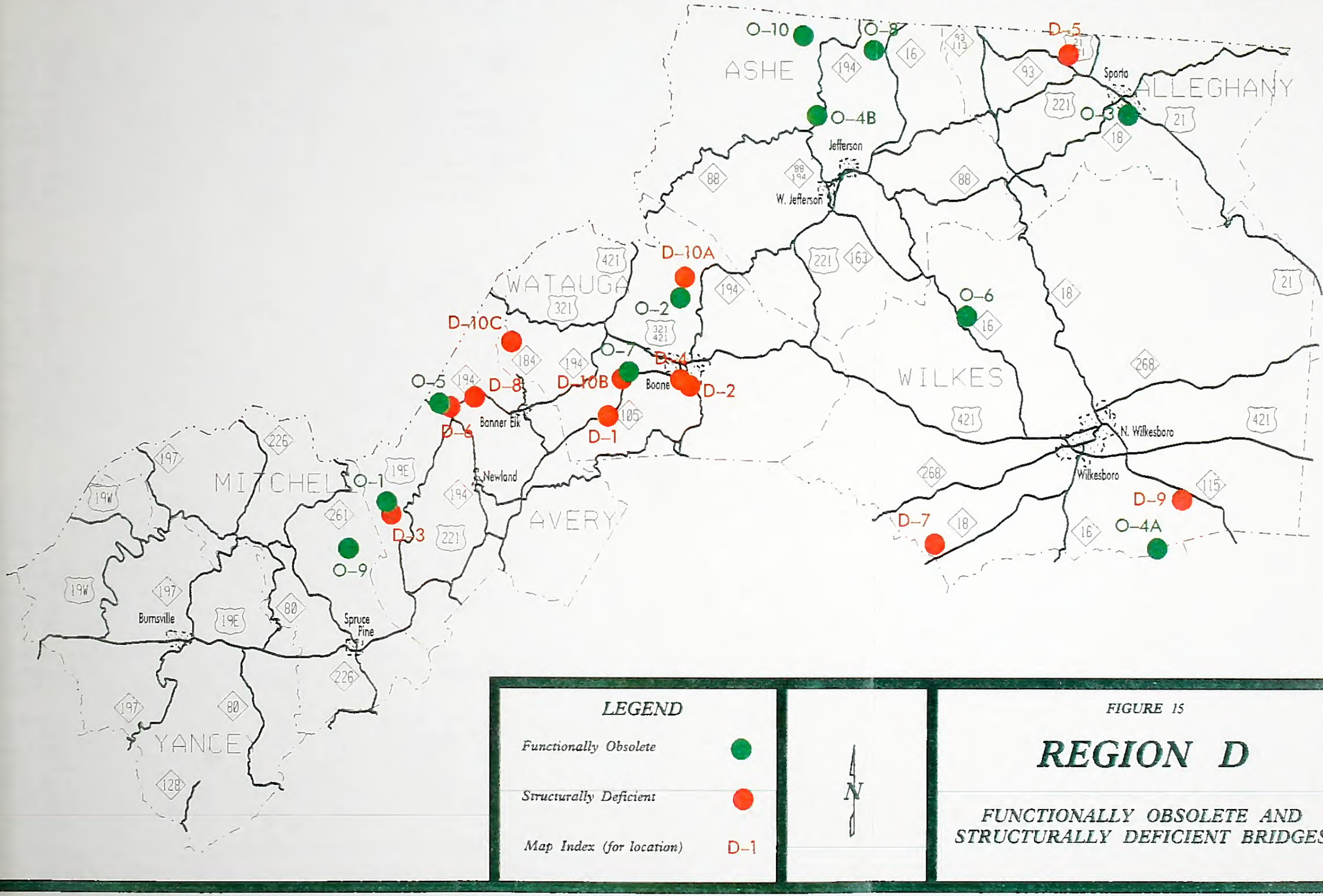
The Ten Most Functionally Obsolete Bridges in Region D

County	Map Index	Sufficiency Rating	Bridge No.	Location
Avery	O-1	26.0	040	SR 1132 JCT US 19E
Watauga	O-2	27.5	231	SR 1337 JCT SR 1336
Alleghany	O-3	28.9	150	SR 1171 JCT US 21
Wilkes	O-4A	33.2	034	SR 1001 JCT SR 2482
Ashe	O-4B	33.2	273	SR 1347 JCT NC 194
Avery	O-5	33.5	033	SR 1305 JCT SR 1303
Wilkes	O-6	33.8	718	SR 1580 JCT SR 1562
Watauga	O-7	36.1	093	SR 1109 JCT NC 105
Ashe	O-8	36.2	289	SR 1536 JCT SR 1528
Mitchell	O-9	36.3	175	SR 1206 JCT SR 1241
Ashe	O-10	37.1	281	SR 1358 JCT SR 1362

TABLE 14

The Ten Most Structurally Deficient Bridges in Region D

County	Map Index	Sufficiency Rating	Bridge No.	Location
Watauga	D-1	3.3	298	SR 1580 JCT NC 105
Watauga	D-2	4.0	324	SR 1542 JCT SR 1943
Avery	D-3	6.0	067	SR 1130 JCT US 19E
Watauga	D-4	7.0	010	SR 1547 JCT US 321
Alleghany	D-5	13.7	265	SR 1345 JCT SR 1342
Avery	D-6	14.2	092	SR 1170 JCT SR 1303
Wilkes	D-7	14.6	059	SR 1130 JCT SR 1129
Avery	D-8	15.2	028	SR 1321 JCT NC 194
Wilkes	D-9	15.6	024	SR 2428 JCT NC 115
Watauga	D-10A	15.7	033	SR 1335 JCT SR 1339
Watauga	D-10B	15.7	094	SR 1111 JCT NC 105
Watauga	D-10C	15.7	320	SR 1153 JCT SR 1125


O–10
O–8
D–5
ASHE
Sparta
ALLEGHANY
O–4B
O–3
Jefferson
W. Jefferson
D–10A
WATAUGA
O–2
O–6
D–10C
O–7
D–4
D–10B
Boone
D–2
O–5
D–8
D–6
Banner Elk
D–1
WILKES
N. Wilkesboro
Wilkesboro
MITCHELL
O–1
Newland
D–3
AVERY
D–9
D–7
O–4A
O–9
Burnsville
Spruce Pine
YANCEY
LEGEND
Functionally Obsolete
Structurally Deficient
Map Index (for location) D–1
N
FIGURE 15
REGION D
FUNCTIONALLY OBSOLETE AND STRUCTURALLY DEFICIENT BRIDGES

VI. TRAFFIC MODEL DEVELOPMENT

In order to develop an efficient Thoroughfare Plan for Region D it was necessary to develop and calibrate a traffic model of the Region. To develop a traffic model the following things are necessary: define the study area, collect traffic counts and socioeconomic data, determine the trip generation characteristics of the study area, calibrate the traffic model so that it duplicates patterns of the study area, and project the socioeconomic data to the design year. Once the socioeconomic data has been projected the model may be used to evaluate various street system problems and alternate solutions to the problems.

The Study Area

The study area for Region D consists of the seven counties that make up the area. This area was divided into 56 zones for data collection and aggregation (Figure 16). These zones are the Townships of each county. Townships that had no major roads passing through them or had very little population and employment were not used. The data for the dwelling units and employment was collected from 1990 census data. The projections of the socioeconomic data to the future year was done based on past trends from previous census data and county projections made by the Office of State Planning.

The Base Year Network

The purpose of the traffic model is to replicate the conditions on the major routes between the cities of Region D. Therefore it is necessary to represent these routes in the model. There is a balance between having too many streets on the model to allow the model to be calibrated and not having enough streets on the model to realistically duplicate existing conditions. Generally all the major arterials and some of the major collectors routes need to be represented in the model.

Street capacity is an important component of the model. The volume/capacity ratio (v/c) gives us our best indication of present and future traffic congestion.

Speed and distance are the major factors that define the minimum time paths from zone to zone. The model uses the minimum time paths as the basis for assigning traffic to streets. Generally in the Region D model, the speeds assigned to links of the street system are at or slightly below the posted speed limit. Common speeds used in the model are 20, 35, 40, and 50 miles per hour.

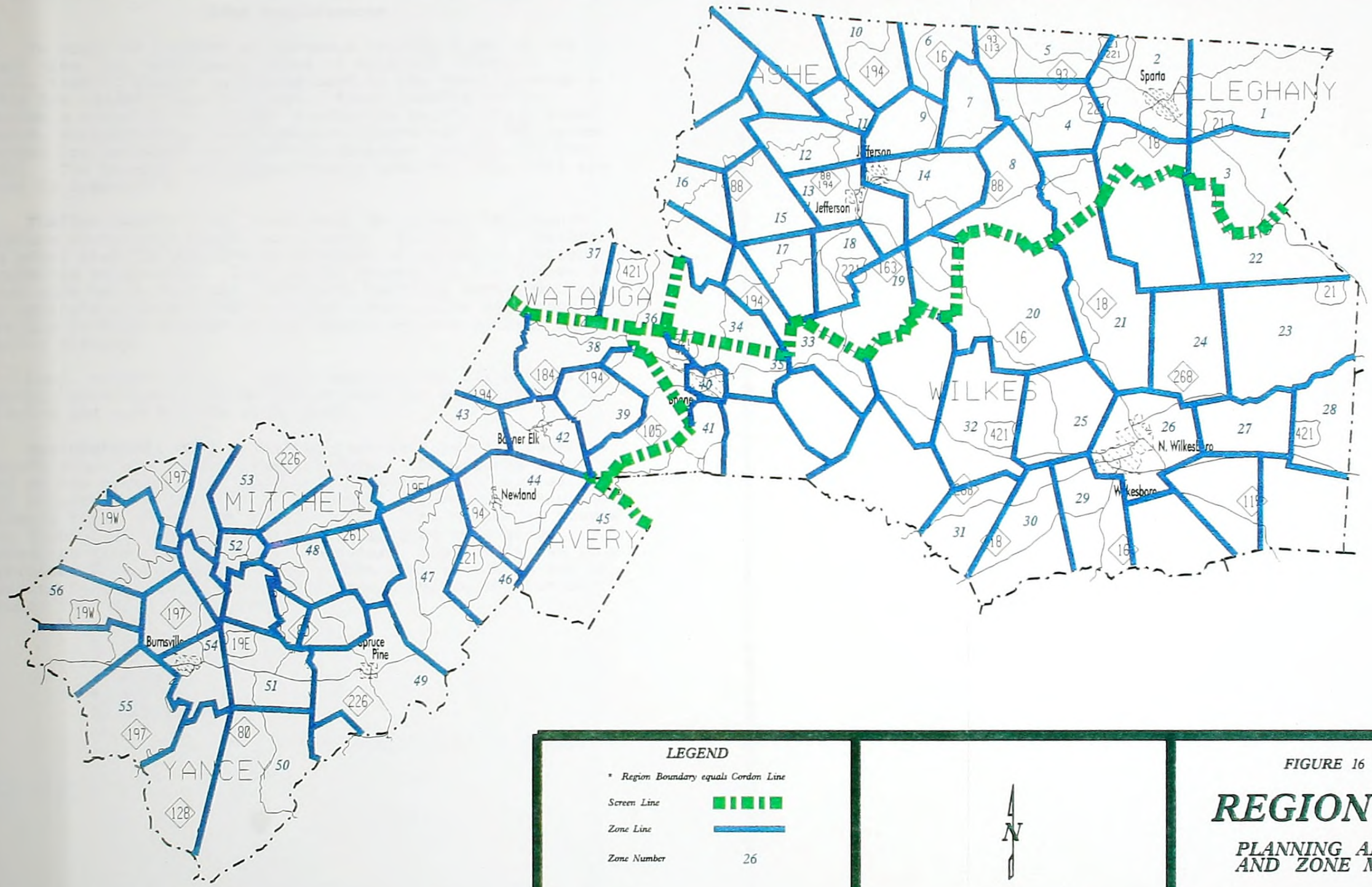


FIGURE 16

REGION D

PLANNING AREA AND ZONE MAP

Data Requirements

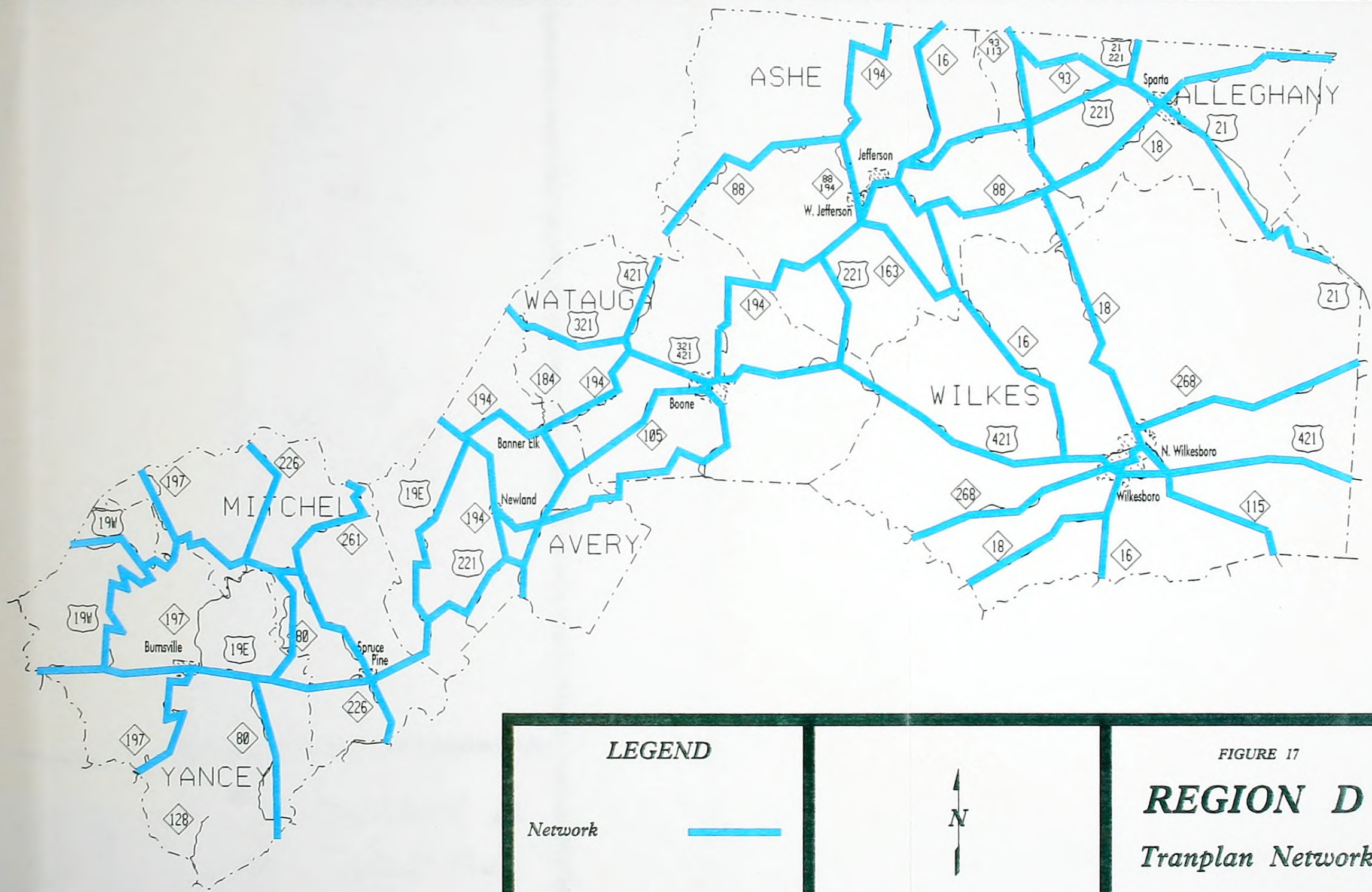
In order to produce an adequate traffic model of the study area, two additional types of data are required. First, traffic counts on routes used in the model provide a basis for calibrating the model. These traffic counts provide a snapshot of traffic conditions in the study area. Second, socioeconomic data (housing counts and an employment survey) are necessary in order to generate traffic for the model. The housing and socioeconomic data for the model are shown in Appendix A.

Traffic Counts - The model must be calibrated against existing conditions in the study area. In order to calibrate the model traffic counts must be taken at various locations around the study area. The traffic counts for the Region D study were taken from the 1990 North Carolina Department of Transportation County Traffic Maps. These come from count stations located throughout the region and are average daily traffic volumes.

Also, volumes on all routes crossing the planning area boundary were found. These counts show how much traffic is entering and exiting the study area.

Socioeconomic Data - The required data has two forms: a housing count and an employment survey. The housing count is used as the generator of traffic. Employment is used as a trip attractor in the model. The model assumes that housing produces trips while jobs attract trips. The number of houses were found from the census data and assigned an average generation rate of 5 trips per household. Employment was also determined from the census data. This data is broken out by Standard Industrial Code from the census bureau and can be grouped into five categories:

1. Industry;
2. Special Retail;
3. Retail;
4. Office; and
5. Services.



LEGEND

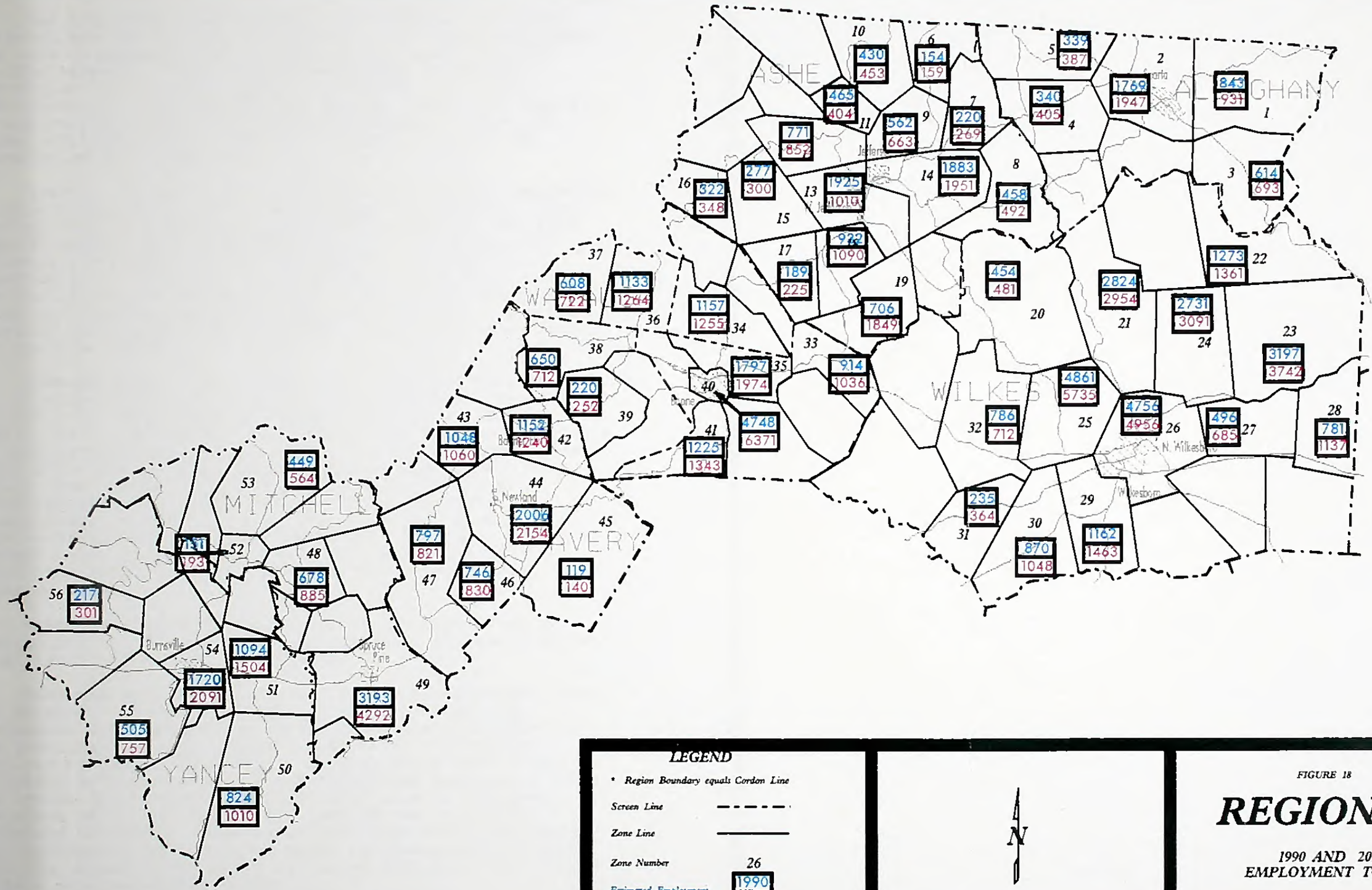
Network

N

FIGURE 17

REGION D

Tranplan Network



LEGEND

- Region Boundary equals Cordon Line
- Screen Line
- Zone Line
- Zone Number — 26
- Estimated Employment — 1990 / 2020

N

FIGURE 18

REGION D

1990 AND 2020 EMPLOYMENT TOTALS

Trip Generation

The trip generation process is the process by which external station volumes, housing data, and employment data are used to generate traffic volumes that duplicate the traffic volumes on the street network. The technical definition of a trip is slightly different then the definition of a trip used by the general public. Technically a trip only has one origin and one destination while the layman will often group, or chain, several short trips together as one longer trip.

Traffic inside the study area has three major components through trips, external-internal trips, and internal trips. Through trips are produced outside the study area and pass through enroute to a destination outside the study area. External-internal trips have one end of the trip in the planning area. Internal trips have both their origin and destination inside the study area. For clarity the internal trips are further subdivided into trip purposes. The trip purposes for Region D are home-based work, other-home based, and non-home based.

Through Trips - The through trip table for this study was developed based on Technical Report Number 3 (Synthesized Through Trip Table for Small Urban Areas by Dr. David G. Modlin, Jr.). Although this report is not totally applicable to this large planning area, it was the only method available along with some common sense, to develop the through trip table. Once these volumes were developed the fratar balancing method was then used to balance the trip interchanges so that the total number of through trips at each external station is consistent with the total number of through trips at every other station. Generally five iterations are sufficient to balance the error between external zones.

External - internal - trip volume was determined by subtracting the through trip volume at each station from the total traffic volume at that station.

Internal Data Summary - (IDS) is the process that takes the external - internal traffic volumes, housing data, employment data, generation rates, and regression equation and generates the trip production and trip attractions required by the gravity model. Housing units were unable to be stratified to account for differing trip generation rates for income levels because of the large size of the area. Therefore an average generation rate of five trips per household was used. This number was lower than the average trip generation rate of seven trips per household for North Carolina. Based on the rural nature of this area five seemed to be a more reasonable number.

Trip attractions were produced using a regression equations. The regression equations considers trip attractions to be related to the employment characteristics of the traffic zones. The regression equations for Region D are:

$$OHB \quad Y = .10X_1 + 2.0X_2 + 8.4X_3 + 2.6X_4 + 2.5X_5 + .30X_{10}$$
$$NHB \quad Y = .20X_1 + 2.0X_2 + 8.4X_3 + 2.6X_4 + 2.5X_5 + .10X_{10}$$
$$EXT \quad Y = .50X_1 + 2.0X_2 + 8.4X_3 + 2.6X_4 + 2.5X_5 + .10X_{10}$$

WHERE:
- Y = Attraction factor for each zone
- X1 = Industry (SIC codes 1-49)
- X2 = Retail (SIC codes 55,58)
- X3 = Special Retail (SIC codes 50-54, 56, 57, 59)
- X4 = Office (SIC codes 60-67, 91-97)
- X5 = Services (SIC codes 70-76, 78-89, 99)
- X10 = Attraction caused by housing (N/A)

The output of the IDS program are trip productions and trip attractions for each zone divided into four trip purposes. Home based work, non-home based, other-home based and external-internal. The trips are segregated into trip purpose because different trip lengths are associated with each trip purpose.

Internal Trip Distribution

Once the number of trips per traffic zone is determined the trips must still be distributed to other traffic zones. The preferred method of distributing internal trips, called the 'Gravity Model', states that the number of trips between Zone A and Zone B is proportional to the number of trips produced in Zone A multiplied by the number of trips attracted to Zone B multiplied by a travel time factor. The gravity model takes the form:

$$T_{ij} = \frac{P_i \times A_j \times F_{ij}}{\text{Sum } x=1,n \text{ of } A_x F_{t'x}}$$

- T_{ij} = The number of trips produced in zone i and attracted to zone j.
- P_i = The number of trips produced in zone i.
- A_j = The number of trips attracted to zone j.
- F_{ij} = The travel time factor.
- n = The total number of zones.
- i = The origin zone number.
- j = The destination zone number.
- x = Any zone number.

The travel time factor or friction factor (F) is critical to the gravity model distribution and must be derived empirically. The friction factor is dependent on the distance between the traffic zones and the time necessary to

travel the distance between these zones. This factor is also dependent on the trip purpose.In order to derive the friction factor a gravity model calibration program is run with an initial friction factor and trip length frequency curve for each trip purpose. The initial friction factors used in the Region D model were 100 for all trip purposes and time increments.

The census data gave an average trip time to work of about 15 minutes for the workers in each township. In order to keep the model from making exceptionally long trips the trip length frequency curves were held to a maximum of thirty-six minutes. Only through trips and a some of the external-internal trips make trips longer than this maximum time. Centriod connectors were also give a large amount of time, 5 to 20 minutes, to keep some of the trips in each zone making them intrazonal trips. Table 19 show the actual values used for the trip length frequency curves.

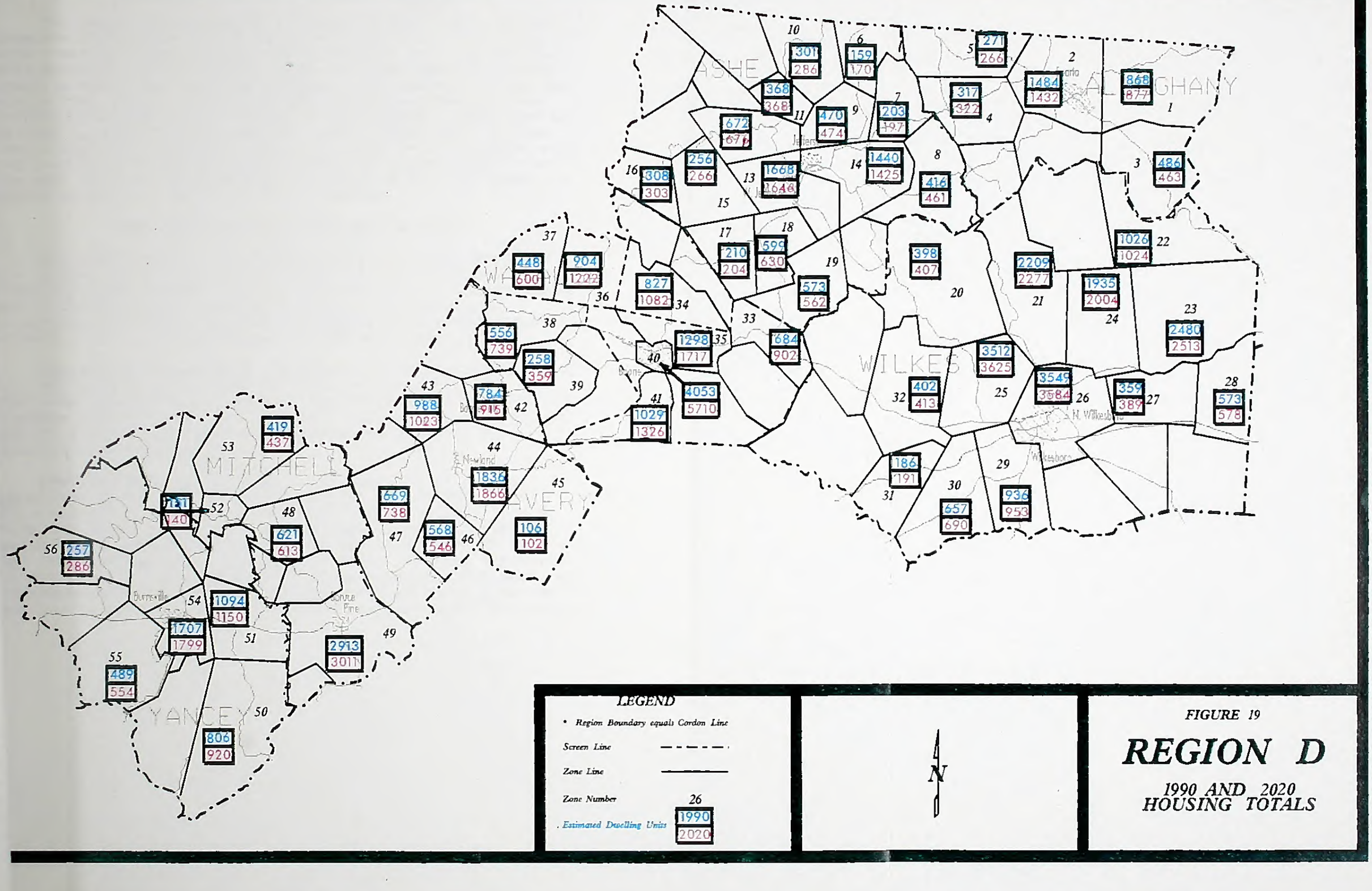
Model Calibration

The purpose of a traffic model is to predict the traffic on a street system at some future point in time; however, if the model is not accurate it is useless for this purpose. Therefore the model must duplicate the existing traffic pattern. The actual calibration of the model is an iterative process in which incremental changes are made either in the trip generation, trip distribution, or the street network. The purpose of each change is to allow the model to more accurately reflect the real world conditions upon which it is based. Only when the model can adequately reflect the existing traffic pattern should it be used to predict traffic in the future.

Accuracy Checks

Due to the coarseness of this network and the limited number of count locations found from count maps, picking screenlines was not easy. East and west movement was checked along the central part of the model east of Boone on US 421, NC 105 and US 221. On this section the assigned traffic was 95% of the ground counts. For north-south traffic a screenline was placed along US 421, NC 194, US 221, NC 16, NC 18 and US 21. On this section the assigned traffic was 113% of the ground counts.

The final check for the model is to match the traffic volumes on the links in the model with the ADT at the same location. The assigned link volumes can be used to find particular places in the network where there are problems. Comparing the assigned link volumes with the average daily traffic volumes was relied on the most to calibrate the model. This comparison did not reveal any problems with the model.



LEGEND

- Region Boundary equals Cordon Line
- Screen Line
- Zone Line
- Zone Number 26
- Estimated Dwelling Units 1990 / 2020

N

FIGURE 19

REGION D

1990 AND 2020 HOUSING TOTALS

Peculiarities of the Region D Model

The Region D network is a coarse network. This causes problems along some of the links when trying to duplicate ADTs. Not all of the links can be exactly the same as the ADTs because of the limited number of centroids that allow trips to enter and exit the network. The network is not so coarse that it does not convey an accurate picture of what traffic is doing between cities in the Region. What has to be kept in mind is that the data used in the model is from census data for townships which are large areas to start with and only major routes between cities are represented. For the data that is available and the type of area the model is trying to imitate it does a very good job.

DATA PROJECTIONS TO THE DESIGN YEAR

The socioeconomic data projections were done based on past trends in the census data and with the Office of State Plannings population projection for each county to the design year. These projections and the previously developed regression equation were used to produce trip productions and attractions in the same manner as the base year.

Employment Projections - A linear projection of the 1990 data was used based on 1980 to 1990 employment growth. Employment projection throughout the region show very moderate growth. With most of this related to the growth of tourism in the area shifting it from manufacturing to assorted services and restaurants.

Dwelling Unit Projections - For dwelling units, the population in the design year developed by the Office of State Planning was factored down to Township populations by using the 1990 County and Township populations. A linear projection of persons per household was made based on 1980 to 1990 Township persons per household data. Housing throughout the Region is not expected to increase by much, with most new construction over the design period being attributed to the decrease in the person per household rate and vacation homes.

External and Through Trips - For the design year external and through trips were projected from the base year using a linear projection of the past growth rate at each external station.

TABLE 15

TRAVEL MODEL INPUT VARIABLES

TRIP PERCENTAGES BY PURPOSE		YEAR	PERSON/DU	PERSONS/VEH
Internal of Total	98%			
HBW	21%	1990	2.53	1.25
OHB	59%			
NHB	20%	2020	2.38	1.00

$$\text{COMPOSITE FACTOR} = \frac{\text{1990 PERSON/VEH}}{\text{2020 PERSON/VEH}} \times \text{USAGE FACTOR} \times \frac{\text{2020 PERSON/DU}}{\text{1990 PERSON/DU}}$$

$$\text{INCREASE FOR GENERATION RATES} = \text{AVERAGE 1990 TRIP RATE} \times \text{COMPOSITE FACTOR} - \text{AVERAGE 1990 TRIP RATE}$$

$$\text{COMPOSITE FACTOR} = \frac{1.25}{1.00} \times 0.99 \times \frac{2.38}{2.53} = 1.16$$

INCREASE FOR GENERATION RATE = (5 X 1.16) - 5 = 0.82
(Use 0.80)

The generation rate used for 2020 is 5.80.

TABLE 16

1990 TRIPS BY HOUSING

Housing Category	1990 Trip Generation Rate	Number of DU's	Trips
Average	5.0	54,894	274,470

Secondary NHB Trips Development:

Note that for NHBS trips, 0.20 was used instead of the 0.30 to 0.50 used in traditional studies. This is due to the rural nature of the area, there is just no place to make NHBS trips.

Secondary NHB Trips = Total Ext-Int Trips − Ext-Int Trips Garaged Inside Planning Area × 0.20

1990 Secondary Trips = (57,384 − 5,489) X 0.2 = 10,379

2020 Secondary Trips = (108,390 − 6,865) X 0.2 = 20,305

The breakdown of internal trips by purpose and percentage of non-home based trips generated externally are shown in Table 17.

TABLE 17

TRAVEL DATA SUMMARY

TYPE	1990	2020
Average Daily Trips per DU	5.00	5.80
Internal Trips	268,981	336,483
Home Based Work	56,486	70,661
Other Home Based	158,699	198,525
Non-Home Based, internal	53,796	67,297
NHB secondary	10,379	20,305
Internal <-> External	57,384	108,390
Through Trips	10,216	41,736
TOTAL DAILY TRIPS	336,581	486,609

TABLE 18

CORDON STATION TRAVEL

COMPUTER STATION	BASE YEAR - 1990 Total ADT	Thru Trip Ends	Ext-Int Trips	FUTURE YEAR 2020 Total ADT	Thru Trip Ends	Ext-Int Trips
66	7,000	1,468	5,532	17,075	7,800	9,275
67	2,300	196	2,104	5,400	832	4,572
68	3,800	482	3,318	6,913	1,332	5,581
69	2,000	158	1,842	5,248	780	4,468
70	700	30	670	1,126	46	1,080
71	7,100	1,508	5,592	12,000	3,902	8,098
72	2,000	156	1,844	4,000	462	3,538
73	2,900	304	2,596	11,600	3,648	7,952
74	7,400	1,634	5,766	16,000	6,850	9,150
75	400	10	390	810	22	788
76	200	6	194	216	0	216
77	4,100	550	3,550	11,185	3,394	7,791
78	100	0	100	100	0	100
79	100	0	100	100	0	100
80	800	38	762	999	38	961
81	220	6	214	440	8	432
82	4,100	550	3,350	8,200	1,850	6,350
83	1,000	48	952	2,830	244	2,586
84	5,000	788	4,212	11,000	3,284	7,716
85	900	44	856	2,460	188	2,272
86	80	0	80	100	0	100
87	1,200	66	1,134	4,080	482	3,598

TABLE 18

CORDON STATION TRAVEL

COMPUTER STATION	BASE YEAR - 1990 Total ADT	Thru Trip Ends	Ext-Int Trips	FUTURE YEAR 2020 Total ADT	Thru Trip Ends	Ext-Int Trips
88	500	20	480	500	12	488
89	1,900	150	1,750	3,560	374	3,186
90	1,200	66	1,134	4,740	644	4,096
91	3,400	388	3,012	7,004	1,364	5,640
92	7,200	1,550	5,650	12,440	4,184	8,256

TABLE 19

FRICTION FACTORS & TRAVEL CURVE DATA
REGION D

	FRICTION FACTORS				TRAVEL CURVES			
					% TRIPS DISTRIBUTED			
TIME INTERVAL	HBW	OHB	NHB	EXT-INT	HBW	OHB	NHB	EXT-INT
1	100	100	100	100	0.00	0.00	0.00	0.00
2	100	100	100	100	0.60	1.00	1.30	1.30
3	100	100	100	100	2.86	3.11	7.53	7.53
4	100	100	100	100	6.90	10.52	12.23	12.23
5	100	100	100	100	18.70	14.91	17.20	17.20
6	25322	23230	35654	190129	16.20	13.80	14.00	14.00
7	41816	43215	62260	169497	13.00	11.70	10.90	10.90
8	63779	72982	99530	148301	10.30	10.00	7.80	7.80
9	90157	112358	146217	127461	7.00	8.10	5.70	5.70
10	118520	158337	198155	107706	5.20	6.50	4.20	4.20
11	145392	205089	248678	89560	4.20	5.00	3.50	3.50
12	167009	245175	290106	73348	3.50	3.90	3.10	3.10
13	180251	271627	315808	59215	2.80	3.00	2.90	2.90
14	183417	280043	322034	47167	2.00	2.20	2.60	2.60
15	176571	269789	308782	37100	1.50	1.50	2.40	2.40
16	161362	243870	279472	25000	1.40	1.10	1.60	1.60
17	140469	207693	239674	20000	1.10	0.80	1.10	1.10
18	116880	167342	195507	18000	1.00	0.70	0.70	0.70
19	93276	128085	152273	14000	0.80	0.60	0.50	0.50
20	71641	93518	113676	10000	0.40	0.50	0.30	0.30
21	53138	65401	81650	9000	0.24	0.40	0.20	0.20
22	38193	43990	56644	8000	0.22	0.30	0.08	0.08
23	26693	28578	38100	5000	0.08	0.20	0.08	0.08
24	18202	18002	24941	4000	0.00	0.10	0.08	0.08
25	12152	11043	15952	3000	0.00	0.06	0.00	0.00
26	7970	6624	10006	2000	0.00	0.00	0.00	0.00
27	5153	3901	6179	1500	0.00	0.00	0.00	0.00
28	3296	2265	3771	900	0.00	0.00	0.00	0.00
29	2092	1302	2283	700	0.00	0.00	0.00	0.00
30	1323	744	1377	300	0.00	0.00	0.00	0.00
31	836	424	830	150	0.00	0.00	0.00	0.00
32	530	243	502	50	0.00	0.00	0.00	0.00
33	338	140	306	5	0.00	0.00	0.00	0.00
34	218	81	189	3	0.00	0.00	0.00	0.00
35	142	48	118	1	0.00	0.00	0.00	0.00
36	0	0	0	0	0.00	0.00	0.00	0.00

NOTE: The travel curves shown above were used initially in the study to develop the friction factors shown from 6 to 30 minutes. These friction factors were first in the model from 1 to 25 minutes but did not allow enough trips out onto the network. After looking over the census data it was found

that most HBW trips in the area averaged 15 minutes. The curves were shifted to have the highest friction factors in the 10 to 18 minute range. For large cities throughout the Region, the centroid connectors were given times greater than this to make most trips intrazonal. The friction factors were also extended to 36 minutes to allow for some longer trips.

VII. RECOMMENDED 1992 THOROUGHFARE PLAN

A Thoroughfare Plan study uncovers the need for new facilities, plus identifies existing and future deficiencies in the existing transportation system. The Thoroughfare Plan is a representation of the existing highway system by functional use, e.g., major thoroughfares, minor thoroughfares plus any new facilities which are needed. The planning methodology enables identification of deficiencies in the existing system, allowing compilation of a list of needed improvements.

This chapter presents an analysis and makes recommendations based on the ability of the existing roadways to serve the present and future travel desires as the Region continues to grow. The usefulness of transportation planning is in the analysis of different highway configurations for their efficiency in serving the Region. The recommended plan sets forth a system of improvements to existing thoroughfares to serve the anticipated traffic and land development needs for Region D. The need to eliminate existing and projected system deficiencies which cause traffic congestion is the primary objective of the plan.

The recommended project improvements are based on the results of a traffic forecast model that uses data on traffic counts, population, housing, and employment to simulate travel (See Chapter VI). With this model each major street and highway in the planning area is analyzed to determine its ability to serve existing and future traffic demands.

Thoroughfare Plan Recommendations

The process of developing, testing and evaluating alternate plans involved a number of considerations. These included Region D area goal and objectives, identified deficiencies (See Chapter V), environmental impacts, and existing and anticipated land development. Aerial photography, topographic mapping, field reconnaissance and discussion with the Region D Council of Government, TTC, RTC and interested local citizens provided additional basis for identifying and evaluating facilities.

The only routes looked at in this thoroughfare plan are functionally classified as Principal Arterials, Minor Arterials and Major Collectors (See Figure 3). Principal Arterials serve all urban areas of over 50,000 population and a large majority of those with populations of 25,000 and over. Minor Arterials link cities and larger towns (over 5,000 population), major resort areas and other major generators that are capable of attracting long distance travel. Major collector roads provide service to county seats not on the arterial system, to larger towns (over 1,000 population), and to other traffic generators of intracounty importance. Elements of the plan have been initially classified as urban or rural. Only major thoroughfares classified as either freeway or other are shown within the

urban planning areas. This is necessary due to the limited detail that can be shown on the map. Elements of the Region D Plan are as follows:

Principal Arterials:	US 421 US 321 NC 105 US 221 US 19E US 19	
Problem Areas (Over or near capacity by 2020)		
Wilkes County	US 421 from NC 16/18 to NC 16 west of Wilkesboro.	
Watauga County	US 421 from SR 1655 west to US 321. US 321 from US 421 south to NC 105.	
Minor Arterials:	NC 16 (Wilkes Co. Line to US 421) NC 18 (Wilkes Co. Line to NC 16) US 21 US 221 (Jefferson to US 421) US 421 (From US 321 split to Tenn.) NC 194 (From US 221 north to Tenn.)	
Problem Areas (Over or near capacity by 2020)		
Wilkes County	NC 16 from US 421 north to SR 1315.	
Avery County	NC 194 from US 221 north to NC 181.	
Major Collectors:	NC 268 NC 18 US 221 NC 93 NC 113 NC 88 NC 80 US 91W	NC 16 NC 194 NC 163 NC 184 US 19E (Ingalls to Elk Park) NC 226 NC 197
Problem Areas (Over or near capacity by 2020)		
Wilkes County	NC 268 from SR 1957 to NC 18. NC 18 from NC 268 South past NC 115 into downtown Wilkesboro.	
Watauga County	NC 194 from US 421 north to SR 1350.	
Avery County	NC 184 from NC 105 north to NC 194.	
Mitchell County	NC 226 from Blue Ridge Parkway north to US 19E.	

Suggestion for Arterials

Listed below are the thoroughfare plan recommendations for the arterials in Region D for the period from 1993 - 2020. These projects are being requested in addition to the upgrade of intrastate system routes (US 421, NC 105, NC 194, US 221 and US 19E and US 19) across Region D that are listed in the 1992 Transportation Improvement Program. Figure 20A shows these recommendations along with right of way protection and feasibility study TIP projects that have no current funding allocated to them.

Wilkes County

US 421 from NC 16/18 to NC 16 west of Wilkesboro. By spanning Region D from the eastern edge of Wilkes County to Tennessee west of Boone in Watauga County, as well as serving as a loop around the south side of Wilkesboro, US 421 is vital for the cohesiveness and economic prosperity of the region. Currently in the 1992-1999 TIP this section of roadway is programed to be widened to four lanes (TIP Number R-2240). The 2020 traffic volume (25,600 vpd), is expected to exceed the capacity of this proposed four lane section due to strip development and its proliferation. Therefore, the relocation of this section is proposed.

NC 16 from US 421 north to SR 1315. Currently scheduled for ROW protection in the TIP as R-2207, upgrade existing two lanes and add climbing lanes. Existing traffic volumes on this section are approximately 8,200 vpd. By the design year this volume is expected to increase to 15,800 vpd. The existing 20-foot wide roadway will not be able to handle this future volume. It is proposed that this section of road be widened to a multi-lane facility.

Watauga County

US 421 from SR 1655 west to US 321, and US 321 from US 421 south to NC 105. Traffic volumes along these routes can be lowered by the construction of the US 421 bypass currently proposed in the existing Boone Thoroughfare Plan.

Avery County

NC 194 from US 221 north to NC 181. The current Newland Thoroughfare Plan along with this Thoroughfare Plan shows this 2 lane 24 foot wide section of roadway approaching capacity by the design year. Currently no improvements are recommended.

Suggestions for the Collector Road System

The projects listed below are suggested improvements to the Collector Road System throughout Region D. These suggestions are in addition to the projects already listed in the Transportation Improvement Program.

Wilkes County

NC 268 from SR 1957 to NC 18. Widen existing roadway to a multi-lane facility. Part of this section, to SR 1966, is included in the TIP as project R-2603 scheduled for R/W protection.

NC 18 from NC 268 south past NC 115 into downtown Wilkesboro. This section can be taken care of by project R-616 in the TIP. R-616 is the Wilkesboro - North Wilkesboro Bypass, NC 18 to US 421, two lanes on four a lane right of way, part on new location. This project is currently scheduled for R/W Protection. It is recommended that this project be upgraded to four lanes instead of the two lanes currently listed in the TIP.

Watauga County

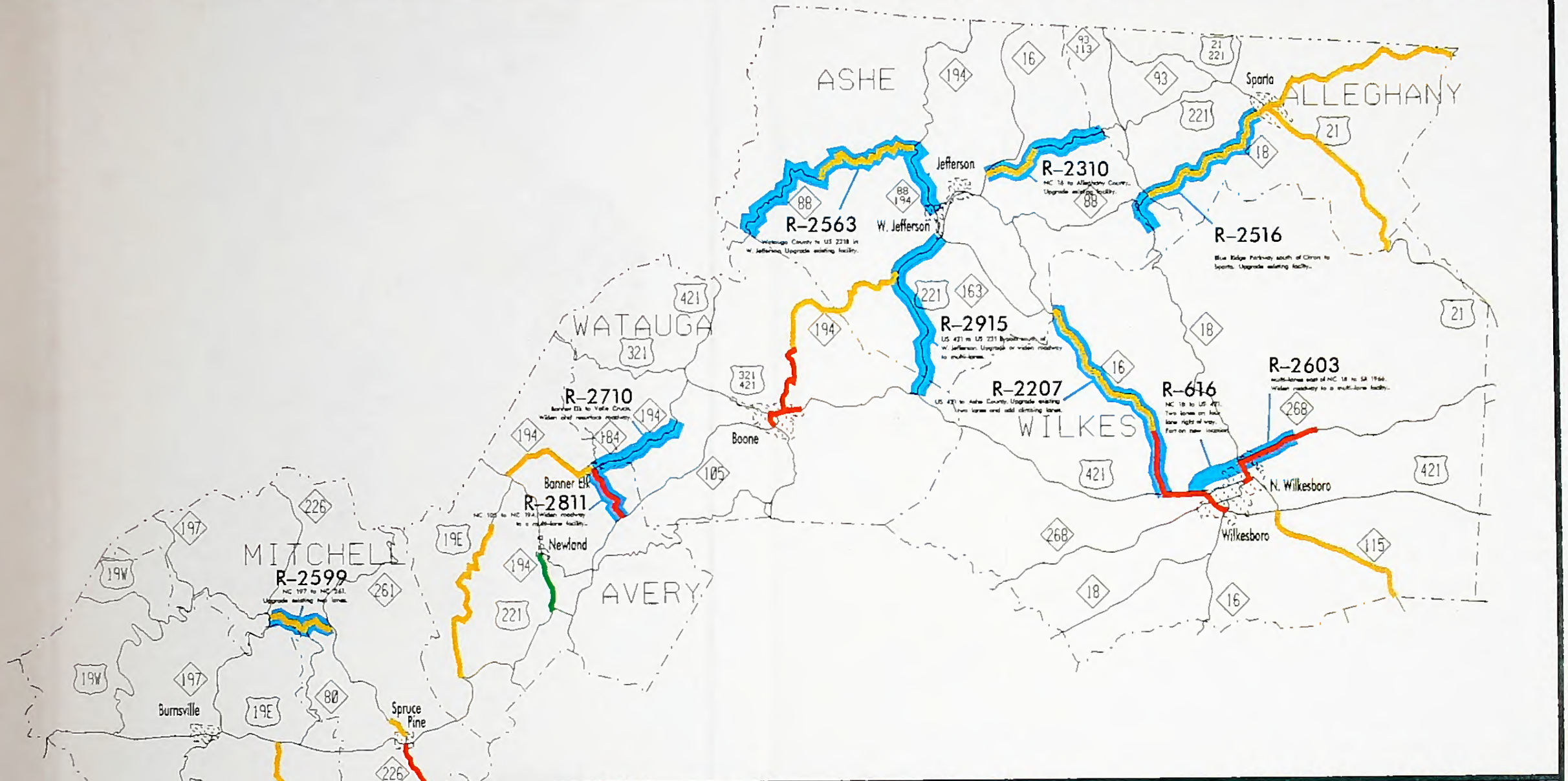
NC 194 from US 421 north to SR 1350. Development is expected to increase alone this route near Boone. It is recommended that this section be widened from 20 - 22 feet to 24 feet with good shoulders to handle future traffic.

Avery County

NC 184 from NC 105 north to NC 194. This section of roadway currently serves tourist traffic to Sugar Mountain, Banner Elk and Beech Mountain. With increased emphasis on tourism the development in this area is expected to increase. Widening the existing roadway to a Multi-lane facility is recommended. (R-2811, Scheduled for ROW Protection)

Mitchell County

NC 226 from the Blue Ridge Parkway north to US 19E. This corridor is the major route into Spruce Pine and the western side of Region D from I-40. Development of the section approaching Spruce Pine is expected to increase near the golf course and the shopping center. Widening the existing roadway to a multi - lane facility is recommended Some improvements for this area are currently in the TIP as R-2598, upgrade existing two lane roadway.



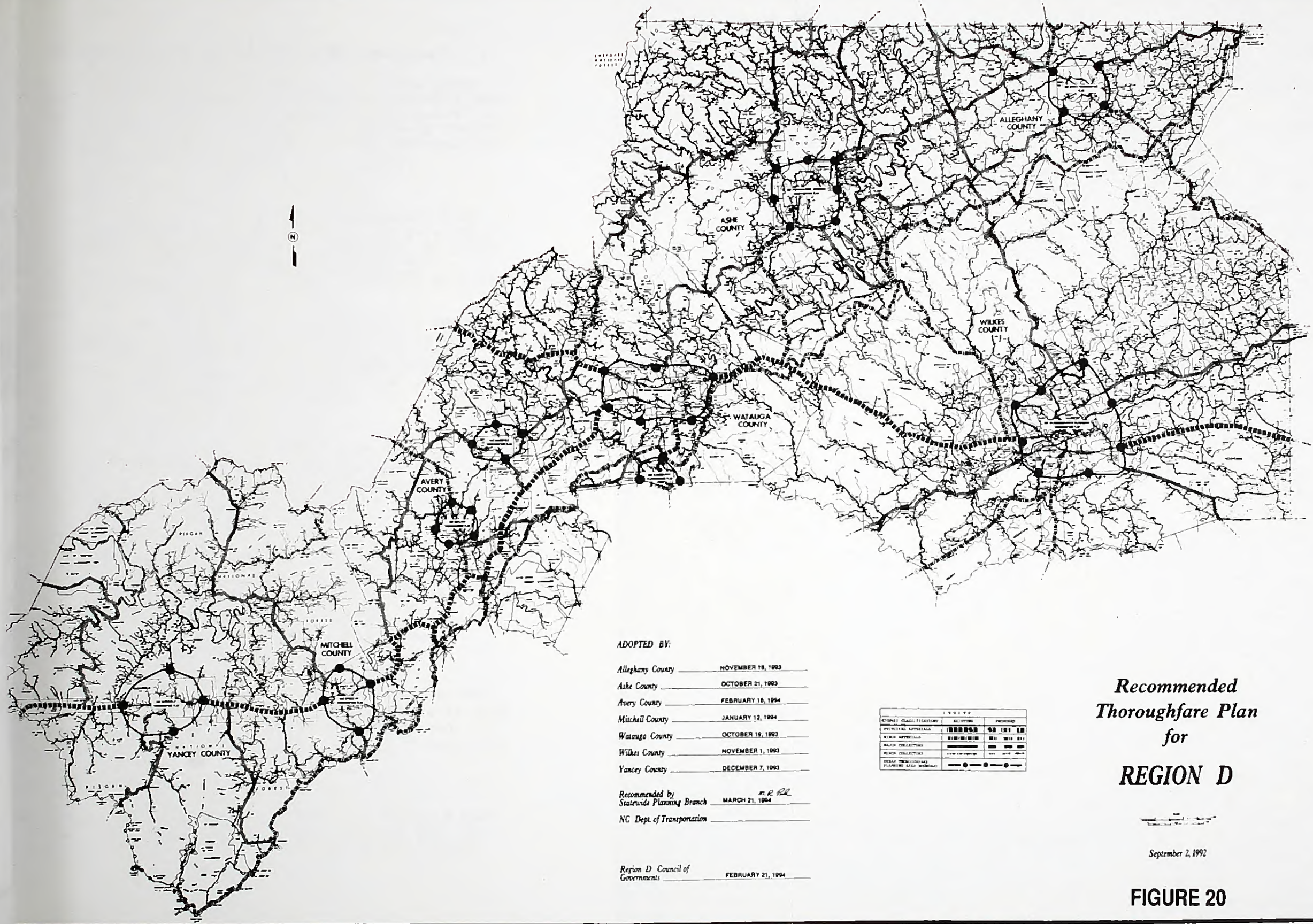
LEGEND

V/C = 0.81 – 0.99	
V/C > 0.99	
Substandard Design	
TIP feasibility and R-O-W protection	

N

Figure 20A

REGION D
Roadway Deficiencies in Design Year 2020



ADOPTED BY:

Alleghany County	NOVEMBER 16, 1993
Ashe County	OCTOBER 21, 1993
Avery County	FEBRUARY 18, 1994
Mitchell County	JANUARY 12, 1994
Watauga County	OCTOBER 19, 1993
Wilkes County	NOVEMBER 1, 1993
Yancey County	DECEMBER 7, 1993
Recommended by Statewide Planning Branch	MARCH 21, 1994
NC Dept. of Transportation	
Region D Council of Governments	FEBRUARY 21, 1994

Recommended Thoroughfare Plan for REGION D

September 2, 1992

FIGURE 20

General Improvements to the System Projects

These improvements are in addition to the ones given in the previous chapter. The routes listed below currently serve below 2,000 vpd. By the design year (2020) these routes are exceed volumes greater than 2,000 ADT (Average Daily Traffic) meeting North Carolina's standards for highway construction call which call for 11 foot lanes.

Mitchell County

NC 226 - From Bakersville to Red Hill. This section of road is 2 lanes, 20 feet wide. In the design year 2020 it is anticipated to carry 2,500 vpd. Therefore, it should be widened to the 2 lanes, 22 feet with improved shoulders. This project is currently in the TIP as R-2599 and is scheduled for ROW protection.

NC 226 - From the Bridge in Spruce Pine north to the Pisgah National Forest boundary. This section is very narrow and curvy with a considerable amount of truck traffic. Safety improvement such as widening to 24 feet and improved shoulders are needed. (R-2599 NC 197 to NC 261. Upgrade Existing Two Lane Raodway)

Yancy County

NC 80 - From US 19E south to SR 1157. This roadway currently carries 2200 vpd, by the design year 2020 this is expected to increase to 3300 vpd. The existing facility is 2 lanes 18 feet wide and should be improved to the minimum 22 feet with improved shoulders.

Avery County

US 19E - From its intersection with NC 194 to Minneapolis. Currently 1,200 vpd use this facility. By 2020 this volume is expected to be 2,600 vpd. The existing roadway is 20 feet wide with rough pavement. General safety improvement need to be completed; widen to 22 feet with improved shoulders.

NC 194 - From Elk Park to Banner Elk is two lanes 20 feet wide with no shoulders. The current traffic volume is 3100 vpd by 2020 this is expected to increase to 6800 vpd. It is recommended that this facility be widen to 24 feet with improved shoulders.

Watauga County

NC 194 - From SR 1350 to the county line NC 194 is a two lane 20 feet wide facility with 3,000 vpd using it. By 2020 this is expected to increase to 6,300 vpd. It is

recommended that this facility be widen to 24 feet with improved shoulders.

Ashe County

NC 194 - From Ashe the County Line to US 221. Currently 1,000 vpd use this facility. By the design year this is expected to increase to 2,800 vpd. Widen roadway from exist 2 lane 20 feet wide to 24 feet wide with shoulder improvements.

NC 88 - From Creston to the NC 194 intersection. Widen the existing 2 lane 20 foot wide facility with 2,400 vpd, to 2 lanes 24 feet that can carry anticipated 3,500 vpd in 2020. (R-2563, Scheduled for ROW Protection)

US 221 - From NC 16 to SR 1571. existing section is 2 lanes 20 feet wide and carries 2,100 vpd. In 2020 this is expected to be 5,600 vpd. Widen to 2 lane 24 feet wide. (R-2310, Scheduled for ROW Protection)

Alleghany County

US 21 - From NC 18 in Sparta to Wilkes County line. The existing roadway is 20 feet wide and carries 4400 vpd with five to ten percent of this traffic being large trucks. By the year 2020 the volume is expected to increase to 6500 vpd. Widen roadway to 2 lanes 24 feet.

NC 18 - From NC 113 to Surry County Line. Current traffic volumes on this section vary from 1000 vpd west of Sparta to 3600 vpd east of Sparta with 5 to 10% of this being truck traffic. The current cross section is 2 lane 20 feet wide with 10 foot grass shoulders. By the design year 2020 traffic volumes are expected to increase to 2000 vpd and 5500 vpd respectively. It is proposed that this facility be widened to 24 feet.

Wilkes County

NC 115 - From county line north to US 412. This route carries a large amount of truck traffic between Wilkesboro-North Wilkesboro and Statesville. It is 2 lanes 20 feet wide with a volume of 2300 vpd. By 2020 this is expected to increase to 5400 vpd. Widen to 24 feet of pavement.

NC 16 - From SR 1557 north to county line. Widen existing facility form 20 feet to 24 and improve shoulders. The current traffic volume is 2800 vpd with a large amount of this being truck traffic from Wilkesboro to Jefferson - West Jefferson. Traffic in 2020 is expected to be 5600 vpd. (R-2207, Scheduled for ROW Protection)

Region D with its natural beauty and mountains is a natural place for many outdoor activities including bicycling. Therefore, it is important to include bicycles in the planning process. Bicycle facility planning is commonly thought of as the effort undertaken to develop a separated bikeway system, composed of bicycle paths and lanes all interconnected and spaced closely enough to satisfy all the travel needs of the bicyclists. In fact, such systems can be unnecessarily expensive and do not provide for the vast majority of bicycle travel. Existing highways, often with relatively inexpensive improvements, must serve as the base system to provide for the travel needs of bicyclists. Bicycle paths and lanes can augment this existing system in scenic corridors or places where access is limited. Thus, bicycle transportation planning is more than planning for bikeways and is an effort that should consider many alternatives to provide for safe and efficient bicycle travel.

North Carolina has two NCDOT designated bike routes which pass through Region D (See Figure 20). The first is the Mountain Connector which connects two main bike routes, Mountains to the Sea and North Line Trace. This connector passes through Yancy, Mitchell, Avery, Watauga, Wilkes and Alleghany Counties on the Blue Ridge Parkway. The other designated route originates at the Virginia Line in Alleghany County and follows NC 93 to US 221 then to US 21 through Sparta to SR 1121 to SR 1114 to SR 1115 onto the Parkway to SR 1108 and SR 1106. SR 1106 then returns you to US 21 which leads to Surry County.

The Blue Ridge Parkway bike route is on a federal highway system in which North Carolina has no control over improvements. The other route, North Line Trace follows state maintained routes for the most part which can be improved. The section of US 21 that this route uses is currently in the TIP for improvements or recommended for improvement in this Thoroughfare Plan. As part of the US 21 improvements either a four foot paved shoulders should be added or the lane widths should be greater than twelve feet. A detailed description of improvements for bike routes can be found in the North Carolina Bicycle Facilities Planning and Design Guidelines.

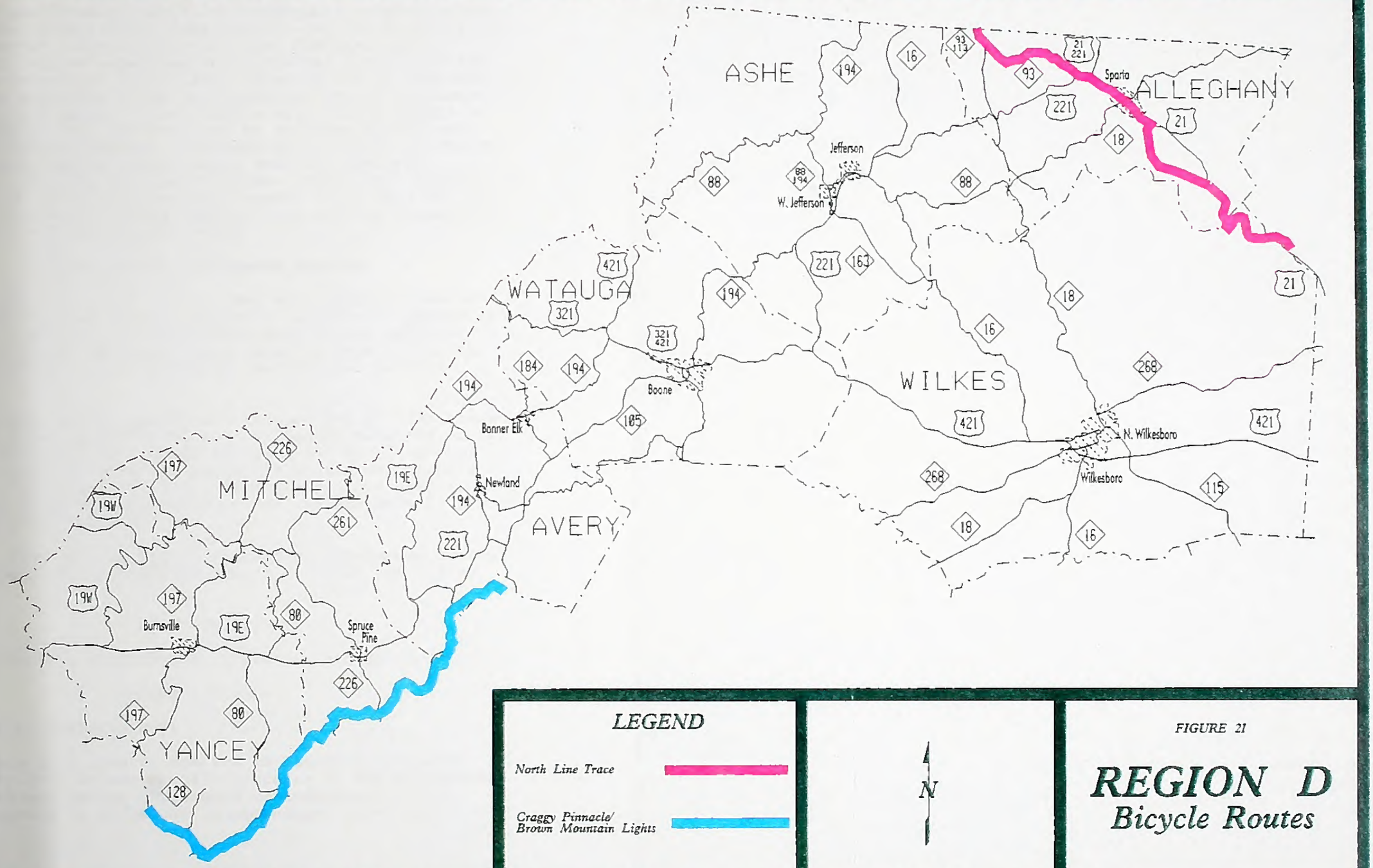


FIGURE 21

REGION D
Bicycle Routes

VIII. ENVIRONMENTAL CONCERNS

In the past several years, environmental considerations in the highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the execution of an environmental impact statement, or EIS, for road projects that have a significant impact on the environment. The EIS can then be reviewed by various federal and state agencies. Included in an EIS would be the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below.

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within Region D was done to determine the effects that new corridors could have on the wildlife. These species were identified using mapping from the North Carolina Department of Environment, Health, and Natural Resources.

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we are able to avoid or minimize these impacts.

Two federally listed threatened or endangered species have been identified throughout Region D. They are listed below.

Avery County

Endangered:
Plecoths Townsendii Virginianus (Virginia Big-Eared Bat)

Mitchell County

Endangered:
Myotis Sodalis (Indiana Bat)

There are also several species in Region D that are significantly rare or are special concerns in North Carolina. These species may become threatened or endangered in the future and should be looked at in subsequent planning studies.

Other Environmental Concerns

Designated Public Mountain Trout Waters

The waters listed below not only support trout, but also are open to public access. Streams located on private lands which are posted against trespass throughout their length are not listed even though the may support trout. Stream names and lengths are taken from USGS 1:24000 topographic maps.

All waters located on the game lands listed below are designated public mountain trout waters. Streams on other game lands are listed in the county where located.

Public Mountain Trout Waters Locations: Elk Ridge Game Land in Ashe County. Pisgah National Forest Game Lands in Avery, Mitchell, and Yancy counties.

Wild Trout Waters

Throughout the State of North Carolina approximately 1,100 miles of high quality trout streams capable of sustaining trout populations by natural reproduction are designated as Wild Trout Waters. These waters are located on private and public lands. All designated public mountain trout waters located on game lands are classified as wild trout waters unless classified and posted otherwise. All wild trout waters located on private lands are marked with identifying BLUE AND GOLD SIGNS that are posted conspicuously along the watercourses (See Figure 22).

Wild trout waters provide fishing for stream reared trout and are not stocked with catchable size fish. In order to protect these valuable fisheries, size and daily creel limits are more restrictive.

ALLEGHANY COUNTY

Name	Length miles	Portion Designated
Ramey Creek	1	Entire Stream

AVERY COUNTY

Name	Length miles	Portion Designated
Birchfield Creek	2	Entire Stream
Cow Camp Creek	2	Entire Stream
Cranberry Creek	5	Entire Stream
Horse Creek	3	Entire Stream
Jones Creek	2	Entire Stream
Kentucky Creek	4	Entire Stream
* North Harper Creek	13	Entire Stream
* Rockhouse Creek	7	Entire Stream
* South Harper Creek	9	Entire Stream

FIGURE 22

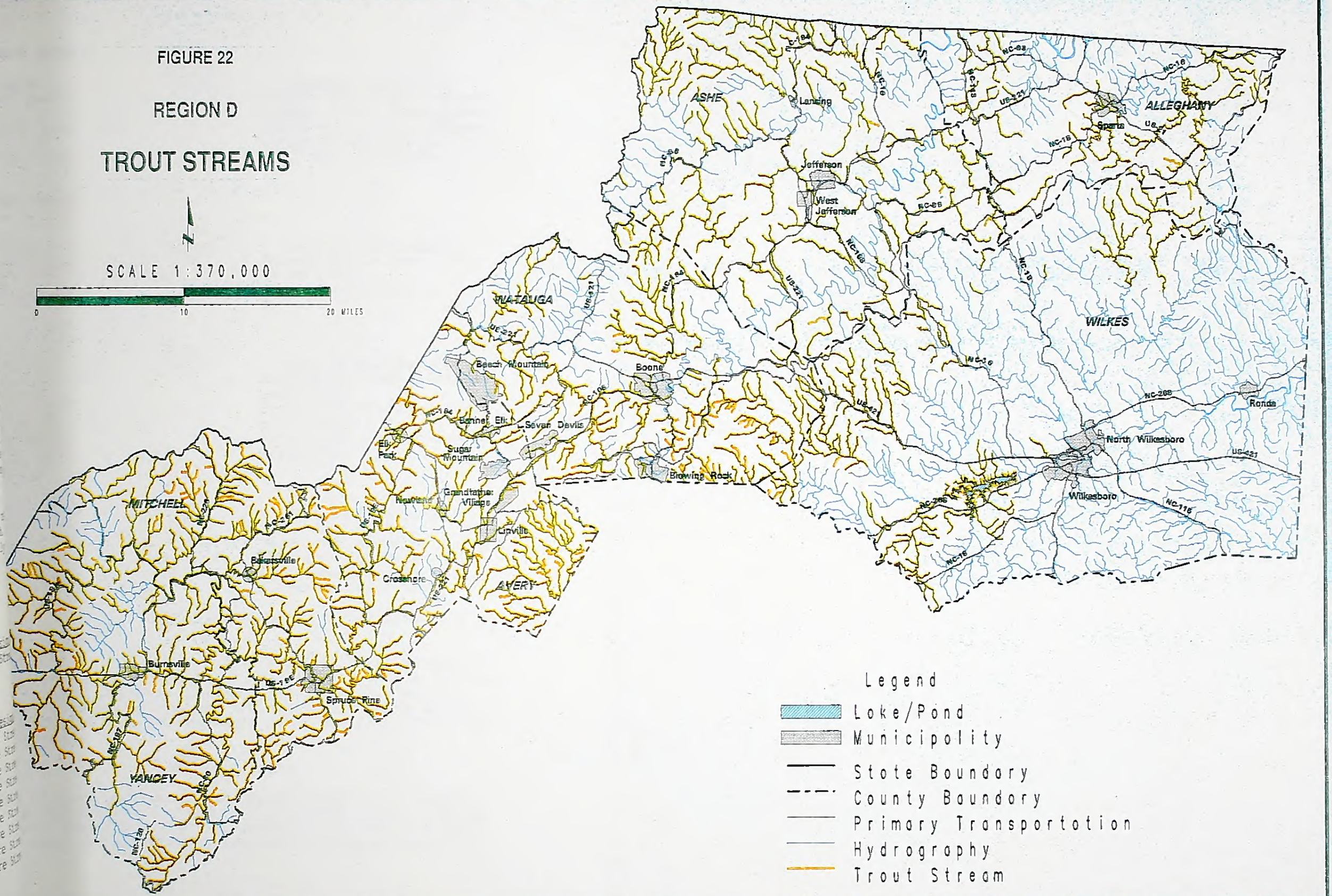
REGION D

TROUT STREAMS

N

SCALE 1:370,000

0 10 20 MILES



MITCHELL COUNTY

Name	Length miles	Portion Designated
Green Creek	3	Headwaters to Green Creek bridge except where posted.
Little Rock Creek	6	Headwaters to Green Creek, except where posted.
* Wiles Creek	3	Entire Stream

WATAUGA COUNTY

Name	Length miles	Portion Designated
Howards Creek	4	Headwaters to lower falls on SR 1306.
Watauga River	4	Avery County line to SR 1559

WILKES COUNTY

Name	Length miles	Portion Designated
Big Sandy Creek	3	Portion on Stone Mountain State Park
Garden Creek	5	Portion on Stone Mountain State Park
Widow Creek	3	Portion on Stone Mountain State Park

YANCY COUNTY

Name	Length miles	Portion Designated
* Lickskillet Creek	3	Entire Stream
* Middle Creek	3	Game land boundary to mouth
* Rock Creek	8	Game land boundary to mouth
* South Toe River	17	Game land boundary down-stream to Clear Creek

* Indicates that all or a portion of the stream lies on game lands.

The above list is just Public Mountain Trout Waters. There are additional Trout Stream in Region D. For a complete listing contact the North Carolina Wildlife Resources Commission Division of Boating and Inland Fisheries 512 N. Salisbury Street Room 458 Raleigh, North Carolina 27604-1188 (919) 733-3633.

Historic Sites

The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve historic sites. In addition, the State of North Carolina has issued its own guidelines for the preservation

of historic sites. These two pieces of legislation are described below:

National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on their properties and consult with Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) - This statute requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. DOT must consider impacts and consult with North Carolina Historical Commission, but it is not bound by their recommendations.

Care should be taken to make certain that all historic sites and natural settings in Region D are preserved. Therefore, a study of Region D properties that are listed on the National Register of Historic Places should be done prior to the construction of any proposal.

IX. IMPLEMENTATION

Implementation is one of the most important aspects of the transportation plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the Counties to assist in the implementation of the thoroughfare plan. They are as follows:

State-County Adoption of Thoroughfare Plan

It is recommended that the counties of Region D and the North Carolina Department of Transportation mutually approve the thoroughfare plan shown in Figure 20. The mutually approved plan may then serve as a guide for the Department of Transportation in the development of the road and highway system for the counties. The approval of the plan by the county also enables standard road regulations and land use controls to be used effectively in the implementation of this plan.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the County Planning Commission a plan of any proposed subdivision. It also requires that subdivisions be constructed to certain standards. Through this process, it is possible to require the subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become a part of the thoroughfare plan. The construction of subdivision streets to adequate standards reduces maintenance costs and simplifies the transfer of streets to the State Highway System. Appendix B outlines the recommended subdivision design standards as they pertain to road construction.

Land Use Controls

Land use regulations are an important tool in that the regulate future land development and minimize undesirable development along roads and highways. The land use regulatory system can improve highway safety by requiring sufficient setbacks to provide for adequate sight distances and by requiring off-street parking.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff from the Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan. Since the County is the first point of contact for developers, it is important that the County advise developers of this review requirement and cooperate in the review process.

Funding Sources

Capital Improvements Program

A capital improvement program makes it easier to build a planned thoroughfare system. This capital improvement program consists of two lists of projects. The first is a list of highway projects that are designated as a municipal responsibility and are to be implemented with municipal funds. The second is a list of local projects designated as State responsibility to be included in the Transportation Improvement Program.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects the Department of Transportation plans for the next seven years. Similar to local Capital Improvement Program projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests in a particular area of the state. Based on the technical feasibility, need, and available funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement projects, highway safety projects, public transit projects, railroad projects, and bicycle projects.

Industrial Access Funds

If an Industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is $150,000 per year per project. A Town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

The North Carolina Highway Trust Fund Law

The Highway Trust Fund Law was established in 1989 as a 13.5 year plan with four major goals for North Carolina's roads and highways. These goals are:

1. To complete the remaining 1,716 miles of four lane construction on the 3,600 mile North Carolina Intrastate System.

2. To construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.

3. To supplement the secondary roads appropriation in order to pave, by 1999, 10,000 miles of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.

4. To supplement the Powell Bill Program.

In this 30-year planning period, Region D should look forward to the paving of most, if not all, of the unpaved roads on the State maintained system. Also, the municipalities in the County which maintain roads will receive increases in their Powell Bill Finds.

For more information on the Highway Trust Fund Law, contact the Program Development Branch of the North Carolina Department to Transportation.

FUNDING SOURCES AND METHODS RECOMMENDED FOR IMPLEMENTATION OF PROJECTS									
PROJECT	Funding Sources				Methods of Implementation				
	Local Funds	TIP Funds	Indust. Access	Small Urban	T-fare Plan	Subdiv. Ord.	Zoning Ord.	Future Street Lines	Development Review
NC 226 Multi-lane Wilkes Co.		X			X				X
NC 226 Bypass Wilkes Co.		X			X				X
NC 16 Multi-lane Wilkes Co.		X			X				X
NC 184 Multi-lane Avery Co.		X			X				X
NC 226 Multi-lane Mitchell Co.		X			X				X

Construction Priorities and Cost Estimates

Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important that minor thoroughfares where traffic volumes are lower. To be in the North Carolina Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment. The potential cost estimate of five Region D projects with respect to the user benefits, probability that economic development will be stimulated and environmental impacts is given in Table 23.

Reduced road user cost should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facilities have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the 30 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is shown as the probability that it will stimulate the economic development of an area by providing access to developable land and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.00 (excellent).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Table 20 lists the items that are considered when evaluating the impacts on the environment. Many of these have been accounted for in evaluation the project with respect user benefits, cost, and economic development potential. However, thirteen environmental factors are generally not considered in these evaluations. They are the environmental impacts of a project on: (1) air quality, (2) water resources, (3) soils and geology, (4) wildlife, (5) vegetation, (6) neighborhoods, (7) noise, (8) educational facilities, (9) churches, (10) parks and recreational facilities, (11) historic sites and landmarks, (12) public health and safety and (13) aesthetics. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project.

TABLE 20

Environmental Considerations

Physical Environment

Air Quality
Water Resources
Soils and Geology
Wildlife
Vegetation

Social and Cultural Environment

Housing
Neighborhoods
Noise
Educational Facilities
Churches
Parks and Recreational Facilities
Public Health and Safety
National Defense
Aesthetics

Economic Environment

Businesses
Employment
Economic Development
Public Utilities
Transportation Costs
Capital Cost
Operation and Maintenance Costs

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. An estimate of anticipated right-of-way costs is also included. Table 22 evaluates the proposed Region D projects with respect to user benefits, estimated costs, probability of economic development, and environmental impact.

Table 21 may be used as a guideline for interpreting the "Probable Impact" values in Table 23.

TABLE 21	
PROBABILITY ESTIMATION GUIDE	
Subjective Evaluation	Impact Probability
Excellent - very substantial	0.90
Very good - substantial	0.60
Fair - some	0.40
Poor - none	0.10

TABLE 22		
Potential Project Cost Estimates Investigated Projects		
Project	**Project Description**	**Total Cost Including R/W**
1	NC 268 Widening, Wilkes Co.	$12,739,000
2	NC 268 Bypass, Wilkes Co.	$22,581,000
3	NC 16 Widening, Wilkes Co.	$ 3,206,000
4	NC 184 Widening, Avery Co.	$ 2,815,000
5	NC 226 Widening, Mitchell Co.	$10,579,000

TABLE 23

Benefits Evaluation for Investigated Projects

Project	Benefits (1000's)	Costs (1000's)	Length Mile	Benefits per Mile	Econ. Dev. Potential	Eviron. Impact
NC 268 2 - 4 ln. Wilkes Co.	$18,733	$12,739	5.3	$3,534	0.50	+0.6 -0.2
NC 268 Bypass Wilkes	$171,086	$22,581	11.0	$15,567	0.50	+0.5 -0.1
NC 16 Multi-lane Wilkes	$21,772	$ 3,206	4.0	$5,443	0.30	+0.4 -0.1
NC 184 Multi-lane Avery	$9,115	$ 2,815	3.3	$2,762	0.80	+0.8 -0.0
NC 226 Multi-lane Mitchell	$14,194	$10,579	4.0	$3,548	0.80	+0.6 -0.0

APPENDICES

APPENDIX A

REGION-D
PLANNING AREA HOUSING AND EMPLOYMENT DATA

TABLE A-1
DWELLING UNIT SUMMARY 1990

ZONE	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	TOTAL DU'S
1	0	0	868	0	0	868
2	0	0	1484	0	0	1484
3	0	0	486	0	0	486
4	0	0	317	0	0	317
5	0	0	271	0	0	271
6	0	0	159	0	0	159
7	0	0	203	0	0	203
8	0	0	416	0	0	416
9	0	0	470	0	0	470
10	0	0	301	0	0	301
11	0	0	368	0	0	368
12	0	0	672	0	0	672
13	0	0	1668	0	0	1668
14	0	0	1440	0	0	1440
15	0	0	256	0	0	256
16	0	0	308	0	0	308
17	0	0	210	0	0	210
18	0	0	599	0	0	599
19	0	0	573	0	0	573
20	0	0	398	0	0	398
21	0	0	2209	0	0	2209
22	0	0	1026	0	0	1026
23	0	0	2480	0	0	2480
24	0	0	1935	0	0	1935
25	0	0	3512	0	0	3512
26	0	0	3549	0	0	3549
27	0	0	359	0	0	359
28	0	0	573	0	0	573
29	0	0	936	0	0	936
30	0	0	657	0	0	657
31	0	0	186	0	0	186
32	0	0	402	0	0	402
33	0	0	684	0	0	684
34	0	0	827	0	0	827
35	0	0	1298	0	0	1298
36	0	0	904	0	0	904
37	0	0	448	0	0	448
38	0	0	556	0	0	556
39	0	0	258	0	0	258
40	0	0	4053	0	0	4053
41	0	0	1029	0	0	1029
42	0	0	784	0	0	784
43	0	0	988	0	0	988

TABLE A-1
DWELLING UNIT SUMMARY 1990

ZONE	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	TOTAL DU'S
44	0	0	1836	0	0	1836
45	0	0	106	0	0	106
46	0	0	568	0	0	568
47	0	0	669	0	0	669
48	0	0	621	0	0	621
49	0	0	2913	0	0	2913
50	0	0	806	0	0	806
51	0	0	1094	0	0	1094
52	0	0	151	0	0	151
53	0	0	419	0	0	419
54	0	0	1707	0	0	1707
55	0	0	489	0	0	489
56	0	0	257	0	0	257
57	0	0	1006	0	0	1006
58	0	0	1132	0	0	1132

TABLE A-2
EMPLOYMENT SUMMARY 1990

ZONE	SIC 1-49 INDUSTRY	50-54, 56,57,59 RETAIL	55,58 SPECIAL RETAIL	70,76 78-89,99 SERVICE	60-67 91-97 OFFICE	TOTAL	TOTAL CAR & TR.
1	487	156	22	128	50	843	0
2	858	235	25	497	154	1769	0
3	334	59	21	136	64	614	0
4	179	28	0	120	13	340	0
5	206	35	0	86	12	339	0
6	100	13	15	26	0	154	0
7	144	17	0	41	18	220	0
8	270	45	6	116	21	458	0
9	428	50	22	52	10	562	0
10	333	15	0	68	14	430	0
11	279	43	6	56	4	388	0
12	522	63	29	138	19	771	0
13	975	373	62	423	92	1925	0
14	970	385	32	402	94	1883	0
15	220	23	0	34	0	277	0
16	206	39	7	54	16	322	0
17	88	7	0	69	25	189	0
18	445	155	32	250	50	932	0
19	355	104	22	189	36	706	0
20	331	52	23	44	4	454	0
21	1563	492	90	509	170	2824	0
22	841	126	39	253	14	1273	0
23	1858	481	95	605	158	3197	0
24	1626	428	122	357	198	2731	0
25	2502	1060	147	799	353	4861	0
26	1918	1087	234	1123	394	4756	0
27	368	44	26	58	36	532	0
28	427	125	17	190	22	781	0
29	724	109	23	233	73	1162	0
30	558	162	32	100	18	870	0
31	159	32	13	31	0	235	0
32	278	81	26	139	27	551	0
33	403	139	9	271	92	914	0
34	414	218	36	425	64	1157	0
35	444	394	80	735	144	1797	0
36	477	236	32	347	41	1133	0
37	273	54	21	231	29	608	0
38	196	109	23	235	87	650	0
39	126	52	0	35	7	220	0
40	635	1 917	69	2737	390	4749	0
41	323	243	14	512	133	1225	0
42	279	179	15	570	109	1152	0
43	479	94	56	370	49	1048	0
44	769	311	100	619	207	2006	0
45	92	0	9	18	0	119	0
46	396	83	17	234	16	746	0
47	456	101	29	178	33	797	0

TABLE A-2
EMPLOYMENT SUMMARY 1990

ZONE	SIC 1-49 INDUSTRY	50-54, 56,57,59 RETAIL	55,58 SPECIAL RETAIL	70,76 78-89,99 SERVICE	60-67 91-97 OFFICE	TOTAL	TOTAL CAR & TR.
48	389	113	9	152	15	678	0
49	1805	534	88	623	145	3195	0
50	465	73	15	198	42	793	0
51	863	83	24	283	73	1326	0
52	111	13	0	31	7	162	0
53	318	24	0	91	16	449	0
54	915	279	41	404	81	1720	0
55	287	70	0	95	53	505	0
56	124	30	0	63	0	217	0
57	366	282	26	505	79	1258	0
58	260	128	5	93	59	545	0

TABLE A-3
DWELLING UNIT SUMMARY 2020

ZONE	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	TOTAL DU'S
1	0	0	877	0	0	877
2	0	0	1432	0	0	1432
3	0	0	463	0	0	463
4	0	0	322	0	0	322
5	0	0	266	0	0	266
6	0	0	170	0	0	170
7	0	0	197	0	0	197
8	0	0	461	0	0	461
9	0	0	474	0	0	474
10	0	0	286	0	0	286
11	0	0	368	0	0	368
12	0	0	676	0	0	676
13	0	0	1646	0	0	1646
14	0	0	1425	0	0	1425
15	0	0	266	0	0	266
16	0	0	303	0	0	303
17	0	0	204	0	0	204
18	0	0	630	0	0	630
19	0	0	562	0	0	562
20	0	0	407	0	0	407
21	0	0	2277	0	0	2277
22	0	0	1024	0	0	1024
23	0	0	2513	0	0	2513
24	0	0	2004	0	0	2004
25	0	0	3625	0	0	3625
26	0	0	3584	0	0	3584
27	0	0	389	0	0	389
28	0	0	578	0	0	578
29	0	0	953	0	0	953
30	0	0	690	0	0	690
31	0	0	191	0	0	191
32	0	0	413	0	0	413
33	0	0	902	0	0	902
34	0	0	1082	0	0	1082
35	0	0	1717	0	0	1717
36	0	0	1222	0	0	1222
37	0	0	600	0	0	600
38	0	0	739	0	0	739
39	0	0	359	0	0	359
40	0	0	5710	0	0	5710
41	0	0	1326	0	0	1326
42	0	0	915	0	0	915
43	0	0	1023	0	0	1023
44	0	0	1866	0	0	1866
45	0	0	102	0	0	102
46	0	0	546	0	0	546
47	0	0	738	0	0	738
48	0	0	613	0	0	613

TABLE A-3
DWELLING UNIT SUMMARY 2020

ZONE	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	TOTAL DU'S
49	0	0	3011	0	0	3011
50	0	0	920	0	0	920
51	0	0	1150	0	0	1150
52	0	0	140	0	0	140
53	0	0	437	0	0	437
54	0	0	1799	0	0	1799
55	0	0	554	0	0	554
56	0	0	286	0	0	286
57	0	0	1304	0	0	1304
58	0	0	461	0	0	461

TABLE A-4
EMPLOYEE SUMMARY 2020

ZONE	SIC 1-49 INDUSTRY	50-54, 56,57,59 RETAIL	55,58 SPECIAL RETAIL	70,76 78-89,99 SERVICE	60-67 91-97 OFFICE	TOTAL	TOTAL CAR & TR.
1	500	183	30	135	83	931	0
2	891	259	27	550	220	1947	0
3	367	62	31	153	80	693	0
4	210	30	0	150	15	405	0
5	232	45	0	95	15	387	0
6	95	19	20	25	0	159	0
7	197	17	0	37	18	269	0
8	275	56	10	130	21	492	0
9	500	50	32	52	29	663	0
10	335	15	0	83	20	453	0
11	279	51	6	64	4	404	0
12	577	63	30	149	33	852	0
13	1000	400	68	450	92	2010	0
14	1000	390	30	431	100	1951	0
15	220	30	0	50	0	300	0
16	220	39	10	54	25	348	0
17	88	30	0	75	32	225	0
18	500	200	45	260	85	1090	0
19	365	115	37	200	42	759	0
20	331	50	35	50	15	481	0
21	1563	540	90	581	180	2954	0
22	869	120	52	300	20	1361	0
23	1858	764	95	830	195	3742	0
24	1664	632	142	446	207	3091	0
25	2505	1490	230	1110	400	5735	0
26	1918	1118	275	1245	400	4956	0
27	445	47	32	102	59	685	0
28	460	217	20	410	30	1137	0
29	801	120	30	434	78	1463	0
30	628	288	32	100	18	1066	0
31	175	60	24	90	15	364	0
32	278	143	50	203	38	712	0
33	453	174	9	300	100	1036	0
34	440	230	38	475	72	1255	0
35	440	420	100	870	144	1974	0
36	538	250	37	400	39	1264	0
37	310	60	23	300	29	722	0
38	150	169	23	270	100	712	0
39	154	58	0	40	0	252	0
40	670	2000	71	3200	430	6371	0
41	375	243	15	560	150	1343	0
42	303	215	22	570	130	1240	0
43	470	90	60	400	40	1060	0
44	750	387	110	664	243	2154	0
45	107	0	15	18	0	140	0
46	415	100	21	274	20	830	0

TABLE A-4
EMPLOYEE SUMMARY 2020

ZONE	SIC 1-49 INDUSTRY	50-54, 56,57,59 RETAIL	55,58 SPECIAL RETAIL	70,76 78-89,99 SERVICE	60-67 91-97 OFFICE	TOTAL	TOTAL CAR & TR.
47	450	101	44	186	40	821	0
48	510	180	14	156	25	885	0
49	2500	700	95	750	247	4292	0
50	494	93	15	360	48	1010	0
51	897	120	30	371	86	1504	0
52	120	21	0	32	20	193	0
53	413	29	0	106	16	564	0
54	1076	351	65	504	95	2091	0
55	381	92	5	129	150	757	0
56	160	32	0	104	5	301	0
57	388	315	35	535	83	1356	0
58	265	150	5	98	81	599	0

APPENDIX B

Typical Cross Sections

Recommended typical cross sections are shown in the following diagrams of Figure 23.

Cross section "A" is illustrative for controlled access freeways. The 46 foot grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Slopes of 8:1 into 3 foot drainage ditches are desirable for traffic safety. Right-of-way requirements would typically vary upward from 250 feet depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 30 feet, but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A", but there may be some variation from this depending upon right-of-way constraints.

Cross section "C", seven lane urban, and cross section "D", five lane urban, are typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns are anticipated as a result of abutting development or frequent street intersections.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 feet is recommended with 30 feet being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections.

Thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "I". Cross section "J" and "K" are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares were parking on both sides is needed as a result of more concentrated development.

Cross section "L" is used in rural areas or for staged construction of a wider multilane cross section. On some thoroughfares projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time.

The curb and gutter urban cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk an the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk further away from the street to provide added separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

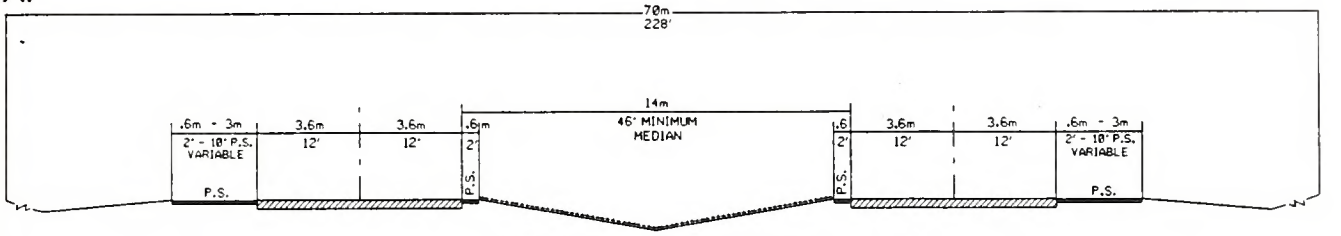
Right-of-way shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle facilities. The North Carolina Bicycle Facility and Program Handbook should be consulted for design standards for bicycle facilities.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way.

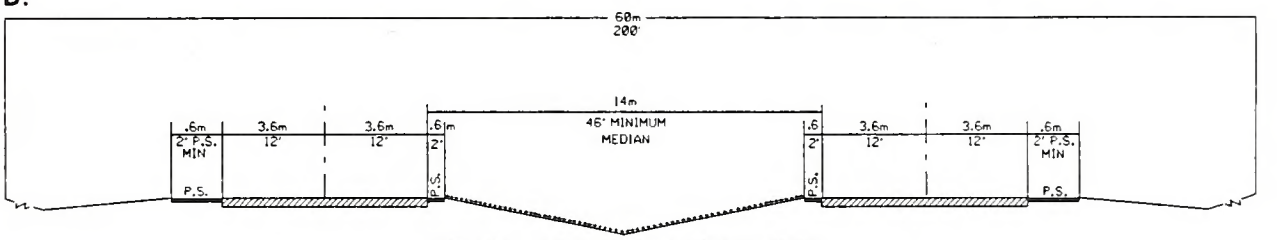
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



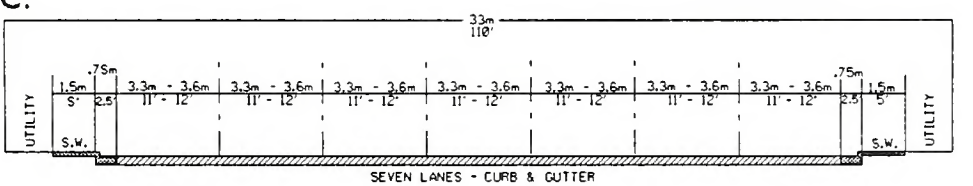
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



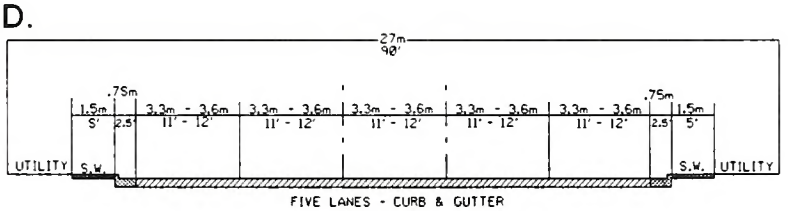
FOUR LANES DIVIDED WITH MEDIAN - PAVED SHOULDER

C.



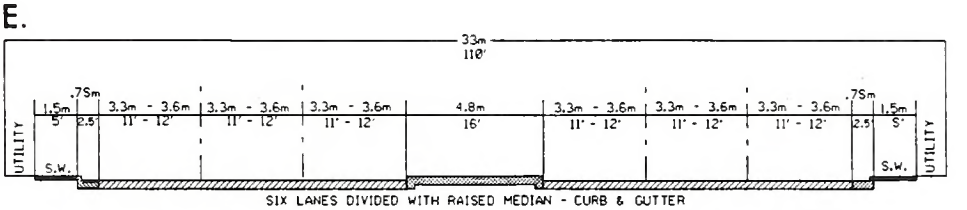
SEVEN LANES - CURB & GUTTER

D.



FIVE LANES - CURB & GUTTER

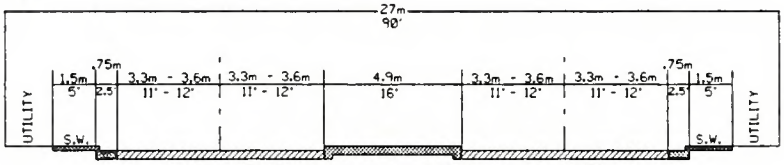
E.



SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

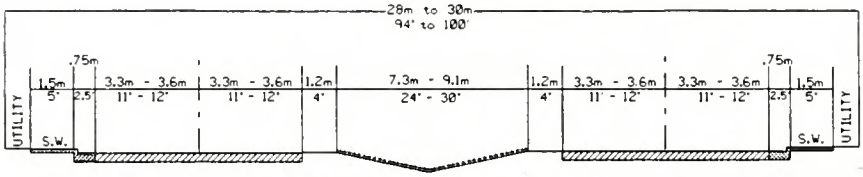
TYPICAL THOROUGHFARE CROSS SECTIONS

F.



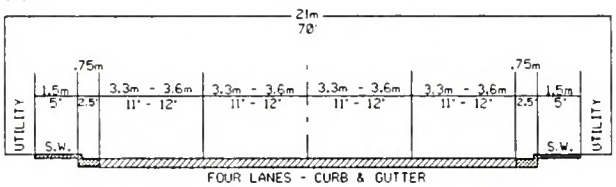
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

G.



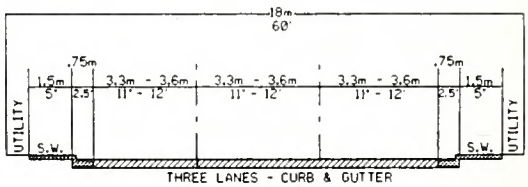
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

H.



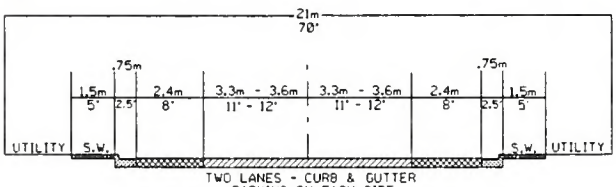
FOUR LANES - CURB & GUTTER

I.



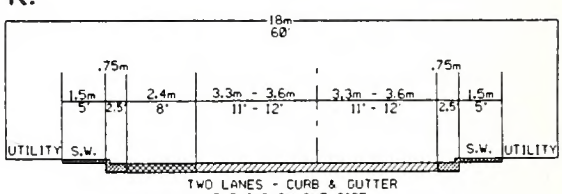
THREE LANES - CURB & GUTTER

J.



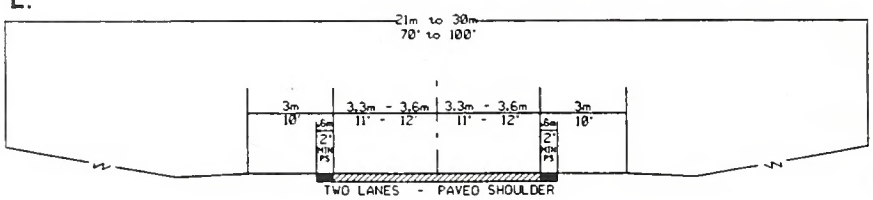
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

K.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

L.



TWO LANES - PAVED SHOULDER

APPENDIX C
RECOMMENDED SUBDIVISION ORDINANCES

DEFINITIONS:

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - a road which serves major intra-county travel corridors and traffic generators and provides access to the arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector System.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares preform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through-traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway - Divided multilane highway designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. (Design speed 70 mph, Operating speed 55 to 65 mph)

2. Secondary Freeway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. The facility provides for the continuous flow of traffic thorough full control of access and the provision of interchanges or grade separation with no access at cross roads, and no traffic signals. (Design speed 50-55 mph, Operating speed 40-45 mph)

3. Parkway - A divided multilane roadway designed for noncommercial traffic, with full or partial control of access. Grade separations are provided at major intersections and there are no traffic signals.

4. Expressway - A divided multilane roadway designed to carry heavy volumes of traffic with full or partial control of access. Interchanges are provided at major intersections. There may be access to service roads and local streets, but there will be no signalized intersections.

5. Secondary Expressway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. This facility may have partial control of access with right turn in and right turn out access to abutting property, and interchanges at major intersections. Some minor intersections may have traffic signal control.

6. Urban Arterial - Multilane roadway with signalized intersections, and access to abutting property. May have grass or barrier type median, or middle left turn lane.

7. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

8. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares, or serve major traffic collectors, and do not collect traffic from more than 100 dwelling units.

9. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

10. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

11. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development of or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm corporation or official agent thereof, who subdivides of develops any land deemed to be subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or recombination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres were no street right-of-way dedication is involved, (3) widening of opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right-or-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the planning area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the counties of Region D.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Min. ROW
1. Rural	
a. Principle Arterial	
Freeways	350 ft.
Other	200 ft.
b. Minor Arterial	100 ft.
c. Major Collector	100 ft.
d. Minor Collector	80 ft.
e. Local Road	60 ft.*
2. Urban	
a. Major Thoroughfare other than Freeway and Expressway	90 ft.
b. Minor Thoroughfare	70 ft.
c. Local Street	60 ft.*
d. Cal-de-sec	Variable**

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than sixty feet in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. when the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

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* The desirable minimum right-of-way (ROW) is 60 ft. If curb and gutter is provided, 50 feet of ROW is adequate on local residential streets.

** The ROW dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to ROW should not be less than distance from edge of pavement to ROW on street approaching turnaround.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 34 feet, face to face of curb Shoulder section: 20 feet to edge of pavement, 6 foot shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 5 mph greater than the posted speed limit. The design speeds for various facilities shall be:

DESIGN SPEEDS			
Facility Type	Design Speed		
	Desirable	Minimum	
		Level	Rolling
RURAL			
Minor Collector Roads	60	50	40
Local roads including Residential Collectors and Local Residential	50	50*	40*
URBAN			
Major Thoroughfares other than Freeway or Expressway	60	50	50
Minor Thoroughfares	60	50	40
Local Thoroughfares	40	40**	30**

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* Based on projected annual average daily traffic of 400-750. In cases where road will serve a limited area and small number of dwelling units, minimum design speeds can be reduced further.

** Based on projected annual average daily traffic of 50-250.

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE		
Design Speed	Terrain	
	Level	Rolling
60	4	5
50	5	6
40	6	7
30		9

b. Minimum grade should not be less than 0.5%.

c. Grades for 100 feet each way from intersections (measured from edge of pavement) should not exceed 5%.

d. For streets and roads with projected annual average daily traffic less than 250 vehicles and grades less than 500 feet long, values may be 150% of that shown in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE				
Design Speed	30	40	50	60
Stopping Sight Distance				
Minimum (ft.)	200	275	400	525
Desirable Minimum (ft.)	200	325	475	650
Minimum K* Value for:				
Crest curve	30	80	160	310
Sag curve	40	70	110	160

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)

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* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide the desired sight distance.

Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

4. The "Superelevation Table" below shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter of 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

SUPERELEVATION TABLE			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30	0.04	302	19 00′
40	0.04	573	10 00′
50	0.04	955	6 00′
60	0.04	1,528	3 45′
30	0.06	273	21 00′
40	0.06	509	11 15′
50	0.06	849	6 45′
60	0.06	1,380	4 15′
30	0.08	252	22 45′
40	0.08	468	12 15′
50	0.08	764	7 30′
60	0.08	1,206	4 45′

e = rate of roadway superelevation, foot per foot

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 200 feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than seven hundred (500) feet in length (for control of speed, visual detection of a dead end street, and for fire protection). The distance from the edge of pavement on the vehicular turnaround to the right-of-way line should not be less than the distance from the edge of pavement to right-of-

way line on the street approaching the turnaround. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purpose accept that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least twenty (20) feet.

3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the deadend as may be required by the Planning Board.

G. Permits for Connection to State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 30 feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 6 feet from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

a. Shoulder section approach

i. Under 800 ADT design year

Minimum 28 feet width face to face of parapets of rails or pavement width plus 10 feet, whichever is greater.

ii. 800 - 2000 ADT design year

Minimum 34 feet width face to face of parapets of rails or pavement width plus 12 feet, whichever is greater.

iii. Over 2000 ADT design year

Minimum width of 40 feet, desirable width of 44 feet width face to face of parapets or rails.

b. Curbs and gutter approach

i. Under 800 ADT design year

Minimum 24 feet face to face of curbs.

ii. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 1'6" minimum, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of useable shoulders on the approach left and right. (Shoulder width 8' minimum, 10' desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

APPENDIX D

STREET TABULATION

The Street Tabulation consists of an alphabetized street listing, with base year and future year traffic, and the recommended cross section for each street. Proposed facilities follow the listing of existing roadways.

Definitions

Capacity: Capacity at Level of Service D
2020 ADT: Average weekday traffic (2020) on existing system 2020 TP ADT: Average weekday traffic (2020) on Thoroughfare Plan system 3 ln: Three lane roadway
5 ln: Five lane roadway
4 dv: Four lane divided roadway
2 lnp: Two lane roadway plus parking lane
adeq: Adequate
N/A: Not applicable

ALLEGHANY COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 18								
FR WILKES CO - BLU R PKWY	0.64	22 (2 ln)	60	12,000	1,600	5,600	Adeq	5,600
BLU R PKWY - NC 113	3.15	22 (2 ln)	100	12,000	1,000	1,800	Adeq	1,800
NC 113 - SCL SPARTA	8.72	18 (2 ln)	60	9,000	1,000	2,000	L	2,000
SCL SPARTA - US 21	3.80	20 (2 ln)	100	10,500	1,000	2,000	L	2,000
US 21 - SR 1403	0.06	26 (2 ln)	100	12,500	3,600	5,500	L	5,500
SR 1403 - NCL SPARTA	0.42	22 (2 ln)	100	11,500	3,600	5,500	L	5,500
NCL SPARTA - SURRY CO	14.47	20 (2 ln)	100	11,000	1,200	4,700	L	4,700
NC 88								
E. ASHE CO LINE - NC 18	0.28	19 (2 ln)	60	9,000	800	1,100	Adeq	1,100
NC 93								
US 221 - SR 1341	2.81	18 (2 ln)	60	9,000	1,200	1,400	Adeq	1,400
SR 1341 - 0.40 PAST SR 1341	0.40	22 (2 ln)	60	12,000	1,200	1,400	Adeq	1,400
0.40 PAST SR 1341 - NC 113	4.79	18 (2 ln)	60	9,000	300	700	Adeq	700
NC 113 - VA LINE	2.19	20 (2 ln)	60	11,000	300	500	Adeq	500
NC 113								
NC 18 - SR 1316	8.70	18 (2 ln)	60	9,000	300	400	Adeq	400
SR 1316 - 0.10 PAST SR 1316	0.10	22 (2 ln)	80	12,000	300	400	Adeq	400
0.10 PAST SR 1316 - NC 93	1.23	18 (2 ln)	60	9,000	300	400	Adeq	400
US 21								
WILKES CO - SR 1172	12.59	21 (2 ln)	60	11,000	4,400	6,500	L	6,500
SR 1172 - SR 1420	0.37	26 (2 ln)	60	13,000	4,400	6,500	L	6,500
SR 1420 - NC 18	0.14	34 (3 ln)	60	13,000	4,400	6,500	Adeq	6,500
NC 18 - WCL SPARTA	0.81	48 (3 ln)	60	13,000	4,400	6,500	Adeq	6,500
WCL SPARTA - US 221	1.00	24 (2 ln)	60	10,500	3,800	6,300	Adeq	6,300
US 221 - VA STATE LINE	3.37	24 (2 ln)	60	9,000	1,890	3,560	Adeq	3,560
US 221								
E. ASHE CO. LINE - NC 113	2.19	16 (2 ln)	60	8,500	350	600	Adeq	600
NC 113 - VA. LINE	11.42	20 (2 ln)	60	11,000	1,000	2,400	Adeq	2,400

ASHE COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 16								
E. ASHE CO LINE - BRIDGE	6.21	(24)(2 ln)	60	11,000	2,000	3,300	TIP R-2100	3,300
BRIDGE - NC 88	0.67	(24)(2 ln)	100	11,000	2,000	3,300	TIP R-2100	3,300
NC 88 - 0.07 PAST NC 88	0.07	36 (2 ln)	60	13,000	4,800	7,200	Adeq	7,200
0.07 PAST NC 88 - US 221	0.22	22 (2 ln)	60	12,000	4,800	7,200	Adeq	7,200
US 221 - SR 1573	4.29	20 (2 ln)	60	11,000	2,400	5,600	Adeq	5,600
SR 1573 - VA. LINE	6.19	22 (2 ln)	100	12,000	2,400	5,600	Adeq	5,600
NC 88								
WATA CO - SR 1122	6.18	18 (2 ln)	60	9,000	900	2,400	Adeq	2,400
SR 1122 - 0.17 PAST SR 1122	0.17	24 (2 ln)	60	13,000	900	2,400	Adeq	2,400
0.17 PAST SR 1122 - 1.30 PAST	1.13	24 (2 ln)	60	9,000	900	2,400	Adeq	2,400
1.30 PAST SR 1122 - SR 1315	3.18	18 (2 ln)	60	9,000	2,400	3,500	L	3,500
SR 1315 - SR 1128	3.58	20 (2 ln)	60	11,000	2,400	3,500	L	3,500
SR 1128 - NC 194	3.40	18 (2 ln)	60	9,000	2,400	3,500	L	3,500
NC 194 - SR 1131	1.49	20 (2 ln)	100	11,000	8,400	10,500	L	10,500
SR 1131 - US 221 BUS	4.79	20 (2 ln)	60	11,000	8,400	10,500	L	10,500
US 221 BUS - ALLE CO	10.45	20 (2 ln)	60	11,000	800	1,000	Adeq	1,000
NC 163								
US 221 - 0.06 PAST US 221	0.06	68 (4 ln)	350	18,000	2,500	4,300	Adeq	4,300
0.06 PAST US 221 - SR 1159	0.16	24 (2 ln)	250	13,000	2,500	4,300	Adeq	4,300
SR 1159 - SR 1181	2.59	22 (2 ln)	100	12,000	2,500	4,300	Adeq	4,300
SR 1181 - NC 16	5.25	20 (2 ln)	100	11,000	2,500	4,300	Adeq	4,300
NC 194								
WATA CO - SR 1113	2.76	20 (2 ln)	60	11,000	1,000	2,800	L	2,800
SR 1113 - US 221	4.41	18 (2 ln)	60	9,000	1,000	2,800	L	2,800
US 221 - NCL W JEFF	5.73	22 (2 ln)	60	12,000	4,300	6,900	TIP R-2915	6,900
NCL W JEFF - ECL LANSNG	5.54	22 (2 ln)	60	12,000	8,400	10,500	L	10,500
ECL LANSNG - BRIDGE	3.07	22 (2 ln)	60	12,000	3,100	4,000	Adeq	4,000
BRIDGE - SR1353	0.09	31 (2 ln)	60	13,000	3,100	4,000	Adeq	4,000
SR 1353 - NCL LANSNG	0.03	24 (2 ln)	60	13,000	3,100	4,000	Adeq	4,000
NCL LANSNG - CHURCH	1.77	18 (2 ln)	60	9,000	1,400	1,600	Adeq	1,600
CHURCH - SR 1527	0.25	22 (2 ln)	60	12,000	1,400	1,600	Adeq	1,600
SR 1527 - VA LINE	2.73	18 (2 ln)	60	9,000	1,400	1,600	Adeq	1,600

ASHE COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
US 221								
WATA CO - NC 194	7.30	20 (2 ln)	100	11,000	3,600	4,100	Adeq	4,100
NC 194 - SCL JEFRSN	4.82	24 (2 ln)	C5	13,000	4,300	6,900	TIP R-2915	6,900
SCL JEFRSN - NC 16-88	0.17	64 (4 ln)	350	35,300	5,400	7,950	Adeq	7,950
NC 16-88 - NC 16	1.00	48 (4 ln)	60	35,300	7,200	11,000	Adeq	11,000
NC 16 - SR 1592	1.31	24 (2 ln)	100	13,000	2,100	5,650	Adeq	5,650
SR 1592 - ALLE CO	9.83	18 (2 ln)	60	9,000	350	600	Adeq	600

AVERY COUNTY STREET SECTION	LENGTH	EXIST CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 105								
US 221 - NCL LINVLE	0.48	22 (2 ln)	100	18,000	7,200	15,600	TIP R-2566	15,600
NCL LINVLE - WATAUGA CO	5.17	22 (2 ln)	100	18,000	7,200	15,600	TIP R-2566	15,600
NC 184								
NC 105 - SCL BANNER ELK	2.69	22 (2 ln)	100	11,000	7,700	11,200	L	11,200
NC 194								
US 19E - SR 1106	0.92	18 (2 ln)	60	9,000	3,400	11,800	TIP R-2520	11,800
SR 1106 - SR 1110	1.48	20 (2 ln)	60	11,000	3,400	11,800	TIP R-2520	11,800
SR 1110 - SR 1112	6.49	22 (2 ln)	60	12,000	5,400	16,500	TIP R-2595	16,500
SR 1112 - NCL NORTH CROSSNORE	0.17	24 (2 ln)	60	13,000	5,400	16,500	TIP R-2595	16,500
NCL CRSSNRE - 0.6 PAST NC 181	3.76	22 (2 ln)	100	11,000	6,400	10,100	Adeq	10,100
0.6 PAST NC 181 - SR 1342	0.06	24 (2 ln)	60	13,000	5,400	10,400	Adeq	10,400
SR 1342 - 0.08 PAST SR 1342	0.08	46 (2 ln)	60	13,000	5,400	10,400	Adeq	10,400
0.8 PAST SR1342 - 0.2 PAST	0.12	38 (2 ln)	60	13,000	5,400	10,400	Adeq	10,400
0.2 PAST SR1342 - SR1175	2.50	20 (2 ln)	60	11,000	5,400	10,400	Adeq	10,400
SR 1175 - SR 1361	0.20	20 (2 ln)	100	11,000	5,400	10,400	Adeq	10,400
SR 1361 - US 19E	2.47	24 (2 ln)	150	13,000	5,400	10,400	Adeq	10,400
US 19E - BRIDGE	0.56	40 (2 ln)	60	13,000	3,100	6,800	L	6,800
BRIDGE - SR 1308	1.90	20 (2 ln)	60	11,000	3,100	6,800	L	6,800
SR 1308 - NC 184	4.49	20 (2 ln)	60	11,000	3,100	6,800	L	6,800
NC 184 - ECL BANNER	1.07	20 (2 ln)	60	11,000	3,100	6,800	L	6,800
ECL BANNER - WATAUGA CO	1.64	18 (2 ln)	60	9,000	800	1,700	Adeq	1,700
US 19E								
FR MITCH CO - SR 1102	0.33	24 (2 ln)	100	13,000	7,500	14,300	TIP R-2520	14,300
SR 1102 - SR 1103	1.01	24 (2 ln)	150	13,000	7,500	14,300	TIP R-2520	14,300
SR 1103 - SCL INGALLS	1.05	48 (4 ln)	120	18,000	7,500	14,300	TIP R-2520	14,300
SCL INGALLS - SCL SPEAR	3.50	24 (2 ln)	100	12,000	1,200	2,200	L	2,200
SCL SPEAR - SR 1138	7.13	20 (2 ln)	60	10,000	1,200	2,200	L	2,200
SR 1138 - FOREST BDY	0.15	28 (2 ln)	60	12,000	1,200	2,200	L	2,200
FOREST BDY - ECL ELK PK	6.83	24 (2 ln)	60	13,000	1,200	2,200	Adeq	2,200
US 221								
AVERY CO - NC 194	1.85	20 (2 ln)	60	11,000	3,000	11,000	TIP R-2595, R-2596	11,000
NC 194 - SCL CRSSNRE	3.19	22 (2 ln)	60	12,000	5,400	16,500	TIP R-2595	16,500
SCL CRSSNRE - ECL CRSSNRE	0.50	20 (2 ln)	60	11,000	5,400	16,500	TIP R-2595	16,500
ECL CRSSNRE - NC 194	0.27	22 (2 ln)	100	12,000	5,400	16,500	TIP R-2595	16,500
NC 194 - 0.10 PAST NC 194	0.10	24 (2 ln)	100	13,000	3,500	12,900	TIP R-2595	12,900
0.10 PAST NC 194 - NCL LINVLE	5.69	20 (2 ln)	100	11,000	3,500	12,900	TIP R-2595	12,900
NCL LINVLE - GRNDFTHR MT.	1.88	18 (2 ln)	60	9,000	400	1,700	Adeq	1,700
GRNDFTHR MT. - CALDWELL CO	6.51	20 (2 ln)	60	11,000	400	1,700	Adeq	1,700

MITCHELL COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 80								
YANCEY CO.- CREEK	10.33	18 (2 ln)	60	8,000	800	1,000	Adeq	1,000
CREEK - NC 226	0.12	20 (2 ln)	100	8,000	300	700	Adeq	700
NC 197								
NC 226 - SR 1417	6.10	16 (2 ln)	60	8,000	500	1,600	Adeq	1,600
NC 226								
S CO. LINE - US 19 E	4.20	24 (2 ln)	100	13,000	7,400	16,000	H	16,000
US 19 E - BRIDGE	0.49	36 (2 ln)	100	12,000	5,400	11,000	TIP R-2119	2,000
BRIDGE - LEFT TURN	0.18	24 (2 ln)	100	11,000	5,400	11,000	TIP R-2119	2,000
LEFT TURN - 0.18 PAST LEFT	0.18	36 (2 ln)	100	12,000	5,400	11,000	TIP R-2119	2,000
0.18 PAST - 0.28 PAST LEFT	0.10	40 (2 ln)	60	12,000	5,400	11,000	TIP R-2119	2,000
0.28 PAST - SR 1150	0.09	22 (2 ln)	60	8,000	5,400	11,000	L	11,000
SR 1150 - FOREST BDY	2.02	20 (2 ln)	60	8,000	5,400	11,000	L	11,000
FOREST BDY - SCL BAKERS	7.38	24 (2 ln)	180	12,000	5,400	11,000	Adeq	11,000
SCL BAKERS - WCL BAKERS	0.67	24 (2 ln)	90	12,000	5,400	11,000	Adeq	11,000
WCL BAKERS - NC 80	0.57	22 (2 ln)	60	11,000	1,700	2,500	L	2,500
NC 80 - NC 197	2.11	18 (2 ln)	60	9,000	1,700	2,500	L	2,500
NC 197 - SR 1338	3.22	20 (2 ln)	100	9,000	800	1,000	Adeq	1,000
SR 1338 - TENN LINE	10.35	18 (2 ln)	100	9,000	800	1,000	Adeq	1,000
US 19 E								
YANCEY CO - 3.30 PAST YNCY	3.30	24 (2 ln)	150	13,000	7,400	11,000	TIP R-2519	11,000
3.30 PAST - ECL SPRU PNE	2.83	24 (2 ln)	300	13,000	7,400	11,000	TIP R-2519	11,000
ECL SPRU PNE - AVERY CO	2.07	24 (2 ln)	100	13,000	7,500	14,300	TIP R-2520	14,300

WATAUGA COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 88								
TENN. LINE - ASHE CO.	1.97	18 (2 ln)	60	9,000	900	2,400	Adeq	2,400
NC 105								
AVERY CO. - BRIDGE	1.75	30 (2 ln)	100	13,000	8,100	13,000	TIP R-2566	13,000
BRIDGE - 8.88 PAST BRIDGE	8.88	22 (2 ln)	100	12,000	8,100	13,000	TIP R-2566	13,000
8.88 PAST BRGE - US 221-321	0.64	44 (4 ln)	100	18,000	11,800	20,300	TIP R-2017	20,300
NC 194								
AVERY CO. - SR 1116	6.06	16 (2 ln)	60	9,000	800	1,700	Adeq	1,700
SR 1116 - US 321-421	0.23	22 (2 ln)	80	9,000	800	1,700	Adeq	1,700
US 321-421 - NCL BOONE	4.47	16 (2 ln)	60	9,000	6,200	13,000	L	13,000
NCL BOONE - ASHE CO.	6.91	20 (2 ln)	60	9,000	3,000	6,300	L	6,300
US 221								
CALD. CO. - WCL BLW RK	6.43	18 (2 ln)	60	9,000	400	1,700	Adeq	1,700
WCL BLW RK - DITCH	1.60	24 (2 ln)	150	12,000	7,100	12,000	Adeq	12,000
DITCH - US 321	0.66	24 (2 ln)	60	12,000	7,100	12,000	Adeq	12,000
US 321 - NCL BLW RK	0.10	24 (2 ln)	140	12,000	7,100	12,000	Adeq	12,000
NCL BLW RK - BRIDGE	0.18	52 (4 ln)	150	35,000	14,400	20,900	See Boone T.P.	20,900
BRIDGE - SR 1542	4.77	50 (4 ln)	150	35,000	14,400	20,900	See Boone T.P.	20,900
SR 1542 - SCL BOONE	1.00	52 (4 ln)	150	35,000	14,400	20,900	See Boone T.P.	20,900
SCL BOONE - US 421	1.40	64 (4 ln)	100	35,000	24,200	32,000	See Boone T.P.	32,000
US 421 - NC 194	0.85	40 (4 ln)	100	20,000	14,000	20,000	See Boone T.P.	20,000
NC 194 - ECL BOONE	0.57	33 (2 ln)	60	13,000	14,000	20,000	See Boone T.P.	20,000
ECL BOONE - URBAN BDRY	0.43	24 (2 ln)	60	13,000	14,000	20,000	See Boone T.P.	20,000
URBAN BDRY - SR 1508	0.71	22 (2 ln)	60	13,000	8,600	14,100	TIP R-529	14,100
SR 1508 - SR 1505	1.40	25 (2 ln)	60	13,000	7,800	14,000	TIP R-529	14,000
SR 1505 - US 421	0.73	20 (2 ln)	60	13,000	7,800	14,000	TIP R-529	14,000
US 421 - ASHE CO.	3.58	20 (2 ln)	60	11,000	4,400	5,000	TIP R-2915	5,000
US 321								
CALD CO. - US 321 BUS	0.61	24 (2 ln)	60	12,000	7,100	12,000	TIP R-2237	12,000
US 321 BUS - US 221-321B	1.23	22 (2 ln)	140	12,000	7,100	12,000	TIP R-2237	12,000
US 221 - US 221 LEAVES US 321	6.40	52 (4 ln)	100	35,000	14,400	20,900	See Boone T.P.	20,900
US 221 - BLAN ST.	0.47	64 (4 ln)	80	22,000	14,000	24,000	See Boone T.P.	24,000
BLAN ST. - US 421	0.14	24 (2 ln)	60	12,000	11,400	16,200	See Boone T.P.	16,200
US 421 - WCL BOONE	1.10	30 (2 ln)	60	12,000	8,100	15,600	TIP R-2615	15,600
WCL BOONE - US 421	5.46	22 (2 ln)	100	12,000	8,100	15,600	TIP R-2615	15,600
US 421 - AVERY CO.	8.90	22 (2 ln)	100	12,000	3,550	5,300	Adeq	5,300

WATAUGA COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
US 421								
WILKES CO. - BRIDGE	1.61	54 (4 ln)	100	13,000	7,400	14,100	TIP R-529	14,100
BRIDGE - US 321	12.04	20 (2 ln)	100	13,000	7,400	14,100	TIP R-529	14,100
US 321 - US 321 LEAVES US 421	6.68	33 (2 ln)	100	12,000	8,100	15,600	TIP R-2615	15,600
US 321 - SR 1372	4.21	24 (2 ln)	150	13,000	6,100	11,700	TIP R-2615	11,700
SR 1372 - 0.57 PAST SR 1372	0.57	36 (3 ln)	150	13,000	6,100	11,700	TIP R-2615	11,700
0.57 PAST SR1372 - TENN. LINE	2.04	24 (2 ln)	150	13,000	5,000	11,000	TIP R-2615	11,000

WILKES COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 16								
COUNTY LINE - THE "Y"	6.47	24 (2 ln)	210	13,000	3,800	6,900	Adeq	6,900
THE "Y" - SR 1617	5.55	48 (4 ln)	210	18,000	17,400	26,400	TIP R-2240	26,400
SR 1617 - SR 1346	3.03	24 (2 ln)	150	12,500	8,200	15,800	TIP R-2207 "D"	15,800
SR 1346 - SR 1559	3.70	18 (2 ln)	60	11,000	2,800	5,600	TIP R-2207	5,600
SR 1559 - ASHE CO	9.67	20 (2 ln)	60	11,000	2,800	5,600	TIP R-2207	5,600
NC 18								
CALD CO - SR 1123	0.11	20 (2 ln)	80	11,000	1,400	2,600	Adeq	2,600
SR 1123 - INTERSECTION	10.99	20 (2 ln)	60	11,000	1,400	2,600	Adeq	2,600
INTERSECTION - NC 16	0.07	24 (2 ln)	100	11,000	1,400	2,600	Adeq	2,600
NC 16 - US 421	3.34	24 (2 ln)	100	18,000	11,300	16,300	Adeq	16,300
US 421 - NC 268	0.30	48 (2 ln)	230	12,000	13,700	18,300	See T.P. N. Wilk	18,300
NC 268 - NC 268	2.83	48 (4 ln)	230	18,000	17,800	23,300	See T.P. N. Wilk	23,300
NC 268 - SR 1976	1.14	44 (4 ln)	60	18,000	20,200	24,600	TIP R-2517	24,600
SR 1976 - NCL N WILK	0.20	24 (2 ln)	60	11,000	14,000	17,300	TIP R-2517	17,300
NCL N WILK - ALLEGNY CO	17.28	20 (2 ln)	60	11,000	1,600	5,600	Adeq	5,600
NC 115								
IRED CO - NC 18	13.32	20 (2 ln)	60	11,000	2,300	5,400	L	5,400
NC 268								
CALD CO -SR 1187	5.00	20 (2 ln)	100	11,000	1,400	2,600	Adeq	2,600
SR 1187 - WCL WILKSB	8.08	24 (2 ln)	60	11,000	1,400	2,600	Adeq	2,600
WCL WILKSB - NC 18	2.83	20 (2 ln)	100	11,000	1,400	2,600	Adeq	2,600
NC 18 - NC 268 ALT	3.52	48 (4 ln)	100	18,000	17,800	23,300	See T.P. N. Wilk	23,300
NC 264 ALT - SR 1979	0.78	52 (4 ln)	100	18,000	10,600	14,400	TIP R-2603	14,400
SR 1979 - 0.11 PAST ECL N WLK	0.17	40 (2 ln)	40	12,000	7,300	14,200	H	14,200
0.11 PST ECL N WLK - SR1957	2.41	20 (2 ln)	100	12,000	7,300	14,200	H	14,200
SR 1957 - SR 2327	5.14	22 (2 ln)	100	12,000	4,400	7,900	Adeq	7,900
SR 2327 - WCL RHONDA	0.14	22 (2 ln)	100	11,000	4,400	7,900	Adeq	7,900
WCL RHONDA - SURRY CO	8.80	22 (2 ln)	60	11,000	4,400	7,900	Adeq	7,900

WILKES COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
US 421								
YADKIN CO - BRIDGE	7.82	24 (2 ln)	150	13,000	7,400	17,100	TIP R-2239	17,100
BRIDGE - ECL WILKSB	7.24	24 (2 ln)	260	12,500	8,000	16,100	TIP R-2239	16,100
ECL WILKSB - NC 268	1.74	48 (4 ln)	260	35,000	14,300	25,600	Adeq	25,600
NC 268 - WCL WILKSB	0.87	24 (2 ln)	260	12,000	15,500	25,500	TIP R-2240	25,500
WCL WILKSB - US 421 BUS	0.16	48 (2 ln)	260	12,000	15,500	25,500	TIP R-2240	25,500
US 421 BUS - SR 1322	0.19	48 (4 ln)	260	18,000	15,500	25,500	TIP R-2240	25,500
SR 1322 - SR 1323	0.30	48 (2 ln)	200	12,000	15,500	25,500	TIP R-2240	25,500
SR 1323 - SR 1143	0.60	36 (2 ln)	200	12,000	15,500	25,500	TIP R-2240	25,500
SR 1143 - DIV 4-LANE	9.69	24 (2 ln)	200	13,000	4,900	14,000	TIP R-2240	14,000
DIV 4-LANE - UNDIV. 4-LANE	4.98	48 (4 ln)	300	37,700	3,800	11,000	Adeq	11,000
UNDIV. 4-LANE - WATA CO	1.52	52 (4 ln)	300	37,700	3,800	11,000	Adeq	11,000

YANCY COUNTY STREET SECTION	LENGTH	EXIT CROSS SEC.	EXIST ROW	PRACT. CAPACITY	1990 ADT	2020 ADT	RECOMMENDED CROSS-SECTION	2020 TP ADT
NC 80								
MCDO CO - FORST BDRY	7.62	18 (2 ln)	60	8,000	400	800	Adeq	800
FORST BDRY - SR 1435	7.78	19 (2 ln)	60	8,000	2,200	3,300	L	3,300
SR 1435 - SR 1424	0.05	18 (2 ln)	60	8,000	800	1,400	Adeq	1,400
SR 1424 - MITCHELL CO	2.45	18 (2 ln)	60	8,000	500	900	Adeq	900
NC 197								
BUNC CO - SR 1101	5.00	14 (2 ln)	60	5,000	200	300	Adeq	300
SR 1101 - FORST BDRY	9.20	20 (2 ln)	60	8,000	1,200	1,600	Adeq	1,600
FORST BDRY - LEAVING US 19BUS	2.35	18 (2 ln)	60	8,000	1,200	1,600	Adeq	1,600
US 19 BUS - MITCHELL CO	10.40	20 (2 ln)	100	8,000	1,300	3,600	Adeq	3,600
US 19								
MADI CO - 0.85 PAST MADI CO	0.85	22 (2 ln)	60	13,000	4,100	11,000	TIP R-2518	11,000
0.85 PAST MADI CO - US 19 W-E	4.04	24 (2 ln)	350	13,000	4,100	11,000	TIP R-2518	11,000
US 19W								
US 19 - INTERSECTION	0.44	22 (2 ln)	60	9,500	700	1,100	Adeq	1,100
INTRSCTN - SR 1354	14.62	20 (2 ln)	60	8,000	700	1,100	Adeq	1,100
SR 1354 - TENN LINE	7.23	18 (2 ln)	60	8,000	100	100	Adeq	100
US 19E								
US 19 - SR 1136	2.29	24 (2 ln)	350	13,000	12,900	15,300	TIP R-2519	15,300
SR 1136 - SR 1115	0.44	24 (2 ln)	220	13,000	12,900	15,300	TIP R-2519	15,300
SR 1115 - WCL BRNSVL	1.77	24 (2 ln)	180	13,000	12,900	15,300	TIP R-2519	15,300
WCL BRNSVL - MITCHELL CO	10.16	24 (2 ln)	150	13,000	7,500	14,300	TIP R-2519,R-2520	14,300